# The Builder.

Vol. LVIII No. 2457. Saturday, March 8, 1890.

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### *The Discovery of Coal in Kent.*

THE Ruskinian "cult" must have been greatly shocked by the discovery of coal between Dover and Folkestone, in a boring at the works of the Channel Tunnel Company during the past few weeks. It would not be at all surprising if "the master" himself were to present us with an indignation paragraph on the subject, for has he not already said in "King's Treasures," "If . . . you could double your income or quadruple it by digging a coal-shaft in the middle of the lawn, and turning the flower-beds into heaps of coke—would you do it? I hope not. I can tell you you would be wrong if you did, though it gave you income sixty-fold instead of fourfold. Yet this is what you are doing with all England"? Already, on nearly all sides, we hear unfavourable comments as to the prospects of the "fair county of Kent" being turned into a "black country," and it may not be uninteresting, on these and on other grounds, to inquire into the nature of the evidence which has been mainly instrumental in producing the scare.

At a point on the South-Eastern Railway adjoining the experimental heading for the proposed Channel Tunnel, a deep boring has, for some time past, been in progress, with the object of investigating the deep-seated geological structure, and especially to learn if coal exists within reasonable limits of depth; and Mr. Francis Brady, C.E., Engineer of the Railway and Tunnel Companies alluded to, reported that on February 15th coal was reached at a depth of 1,180 ft. below the surface, and it was proved to be of good bituminous character. The seam was struck after passing through 20 ft. of clays, grits, and blackish shales belonging to the Coal-measure series, and it is known that the lines of bedding in the shale are distinctly horizontal. Specimens of coal were also taken at 1,182 ft. and 1,183½ ft. from the surface—so ran the official announcement. We are able to add, on good authority, that fossil plants were also discovered which, when duly investigated, will no doubt go far to fix the exact horizon in the Carboniferous formation to which the coal-seam belongs, and so enable us to more safely predict the probable depth of additional seams.

This is unquestionably an important discovery; but before indulging in visionary illusions of the prospect of obtaining coal at the proverbial "eighteen-pence per ton," let us critically examine the value of the evidence bearing on the point. We know that, so far, the coal has been proved to be of good quality, but we require further information to enable us to solve the problems as to whether the seam discovered is associated with others, and, if so, what are their nature, thickness, and depth from the surface, as well as their extent and development underground.

These questions can only be answered by analogy, and the only one that admits of an easy off-hand solution is the consideration of the depth of the seams (assuming more than one to exist) from the surface. Since the discovery, doubts have been expressed as to the commercial results of working a coal-field at such a depth,—such remarks, as usual, emanating from irresponsible persons. A very elementary acquaintance with coal-mining shows how groundless are such fears, for the depth is well within the mining limit. At the Rose Bridge coal-pit, near Wigan, the shaft is nearly 2,500 ft. deep; in Hainault, coal is being worked at the depth of 2,800 ft., and one pit even goes down to 3,411 ft. The chief element in determining the limit within which coal may be won is the increase of temperature which accompanies increase of depth. The thermometer rises 1 deg. in about every 60 ft. of descent for the first 1,800 feet, and the ratio then increases, and it is calculated that at 3,420 ft. the temperature of the air in the mine equals that of the blood. From experience in deep mines, Sir W. W. Smyth is of opinion that the difficulty of temperature may, by due appliances, be overcome for even a greater depth than 4,000 ft. There need, therefore, be no fear but that, if other coal-seams exist anywhere near the one already discovered near Dover, they could be won in the ordinary way.

In regard to the other questions, it may be at once admitted that they can only be answered theoretically, but the theory in this case is accompanied by very strong probability. The mere fact that coal would be found in south-eastern England, and near the spot where it has actually been proved to exist, was predicted by geologists a long time ago. Mr. Godwin-Austen nearly forty years since gave several reasons for his belief in it, which belief was also shared by Professor Prestwich and other well-known geologists. The geological world, therefore, is not surprised at the discovery, though eagerly waiting further results. Certain eminent geologists, however, and amongst them the late Sir Roderick Murchison, were of opinion that, although Carboniferous and other Palæozoic rocks might be met with at great depth in the south-east of England, no coal-field would be found to exist; and from an intimate knowledge of the facts (strengthened by recent research on the Continent) on which this opinion is based, we are bound to say that great deference must be paid to it. To find coal is one thing, but to find it in payable quantities is quite another.

It may be premised that the argument for the extent of the coal measures under our south-eastern counties rests, in short, on the fact that a line of coal-fields runs from Westphalia through the south of Belgium and French Flanders into the Boulonnais, and that these fields present a most striking analogy with the Somersetshire and South Wales coal-fields, which trend in the same direction. In order that the non-geological reader may appreciate the whole question, we may say something respecting the occurrence of the strata concerned in the matter.

The rocks in the region in question, when all are present and in order, are superimposed as follows:—

Palæozoic {
Carboniferous.
Devonian.
Silurian.
Cambrian.

Thus, normally, the Carboniferous beds (including the coal-measures and carboniferous limestone, &c.) lie on the Devonian, and this in turn on the Silurian, and so on. It will be readily seen that under these conditions, if the boring tool reaches the Devonian or other beds under the coal-measures, without passing through these latter, we ought not to expect to find coal at the spot. The general order of succession of the beds is absolutely proved, and does not admit of the slightest discussion—we know, not only from the stratigraphical relations they bear to each other, but from their included fossils, that of these beds the Cambrian is the oldest, and the Carboniferous the youngest. Now, certain of these beds have frequently been met with in borings of great depth in and around the London basin, but hitherto no coal seam has been discovered. At Messrs. Meux & Co.'s Brewery, Tottenham

Court-road, the Devonian was reached at 1,066 ft. from the surface, and bored into 80 ft.; at the New River Co.'s boring at Cheshunt (Turnford) the same horizon was found at 980 ft., and was pierced 30 ft. The geological age of the lowest beds found down to 1,445 ft. in the Richmond boring, which mainly consisted of red marl and sandstone, is not definitely known, in the absence of fossils, but, from the circumstance that small pieces of anthracite were found, it is inferred that the coal measures are not far from the site. It should be remembered, however, that this anthracitic matter was found above the red sandstone beds alluded to, so that this evidence does not preclude the possibility of the latter being of Devonian age. From an inspection of some of the cores brought up in boring, we incline to the opinion of Professor Judd (though not quite from the same reason) that they are younger than the Carboniferous beds. The sandstone does not seem to be sufficiently altered to present the normal appearance of those Devonian beds with which it ought to be compared, whilst in lithological character it very closely resembles the New Red Sandstone, which is younger than the Carboniferous. It is much to be regretted that this and the borings at Crossness, near Erith, which finished at 1,060 ft.; at Kentish-town, which went down to 1,302 ft.; and at Streatham, 1,120 ft., all of which left off in rock of a similar character, were not driven deeper; for, if the coal-measures exist under those spots, they would almost certainly have been reached. In any case, the experiment was well worth trying. At Ware (New River Company's works), in Hertfordshire, at about 796 ft. from the surface, Silurian beds were found and pierced for 35 ft.; whilst at Harwich, Carboniferous beds were met with at 1,030 ft., but the presence of the fossils known as Posidonomyæ showed the horizon to be lower than the coal-measures.

Many other deep borings have been made, but the evidence afforded by them does not immediately concern the subject in hand. We may, however, allude to the deep Sub-Wealden boring, near Battle, which is of a negative character, as it attained a depth of nearly 2,000 feet, ending in rocks of middle oolite, which are very much younger in age than the Carboniferous. This experiment shows that it is not advisable to search for coal in that part of Sussex. The oft-repeated question as to whether coal exists under London is, therefore, not yet definitely settled. Indeed, we are of opinion that none of the evidence obtained from the above-mentioned borings in the London district,—not even in those instances where pre-Carboniferous rocks are proved,—is *per se* absolutely conclusive as to the presence or absence of the coal-measures; for although the super-position of the divisions of the strata, alluded to in the earlier part of the article, holds good as a very general rule (indeed, wherever they have been comparatively undisturbed), the contingency of an exception must unfortunately be made in reference to their relative position under south-eastern England. The coal-measures and Palæozoic rocks, stretching in a line through the south of Belgium to the Boulonnais, were involved in the making and elevation of the Ardennes mountains, of which the Somersetshire and South Wales coal-fields and associated rocks are merely the western prolongation. This does not seem to admit of the slightest doubt. Therefore, the old rocks proved in the deep borings, in the south-east of England, are simply the depressed broad axis of the old Ardennes mountains which run underground from the Boulonnais to Somersetshire, being covered by deposits of younger geological age. This being so, there is no reason why the same stratigraphical phenomena should not be exhibited in the depressed portion of the Ardennes axis, as we find in its elevated and exposed portions on the Continent, on the one hand, and in Somersetshire on the other. It is clear, therefore, that in order to get at the true value of the discovery near Dover, we must study the exposed parts, to which we have just referred, and this we will now briefly proceed to do.

The first thing that strikes us is that the great earth movements which resulted in the elevation of the Ardennes, have considerably fractured and dislocated most of the geological formations concerned, by reason of which the natural order of the beds has been very much upset. In places, hundreds of feet of strata have been completely inverted, whilst "thrust faults" have much disturbed their original positions, the maximum effect of which is that older beds have been forced to occupy a superior position to the coal measures. For example, in the bore-hole of Saint Homme, near Mons, the section is as follows:—

| | | Mètres. |
|---|---|---|
| | Tertiary and Cretaceous beds | 34 |
| Palæozoic | Silurian shales | 78 |
| | Devonian beds | 84½ |
| | Carboniferous] (coal-measures, &c.) reached. | |
| | | 196½ |

It will be seen that the normal positions of these beds have been completely inverted. This is by no means an isolated example. It is the Mons coalfield that so closely resembles the Somersetshire basin. In both areas, the strata are partly inverted, and the coal-seams much cut up, but especially at Mons. In the latter place, a single seam may be passed through six times in one pit 1,050 ft. deep, and the strata which if flat would be 9 miles broad, are squeezed into a space 7 miles across. At Charleroi, the compression is still greater, a breadth of 8½ miles of flat strata being narrowed to less than half that distance by contortion through lateral compression. To the north of the Mendip Hills (Somersetshire coalfield) the seams of the lower coal-measures are bent quite over; in the Nettlebridge Valley, they are ⊃-shaped, slide faults are of common occurrence, and, in fact, the analogy is very complete, not only in regard to the physical disposition of the strata, but to the included fossil plants, in the two areas under discussion. At Ougrée, near Liège, the coal shales are covered by the Devonian, and the same class of structure predominates in the Boulonnais. The question may be asked, in the light of the foregoing facts, whether any one could positively say that, because Silurian or Devonian beds have been found in deep borings in south-east England, the coal-measures do not exist under that region. What is there to show that the older beds are not thrust on to, or inverted over, the coal-measures in that district? We shall see.

Certain evidence tends to show that to the north of the Ardennes, the Palæozoic beds are not so much disturbed, and this throws an important light on the whole question of a Canto-Metropolitan coal-field. The Palæozoic beds, on becoming covered over by newer deposits north of the Ardennes, do not at once plunge very deeply into the earth. At Brussels, Silurian beds are found at depths varying from 63 to 122 mètres; at Denderleeuw they exist at 151 mètres; at Ninove and Grammont, Palæozoic strata were met with at 56 and 46·75 mètres respectively; at Alost, Silurian at 186·9 mètres; at Menin (near Courtrai), Devonian at 156·5 mètres; Flobecq, Silurian at 67 mètres; Tournai, carboniferous limestone at 151 mètres; and at Ostend we get the Silurian at 310 mètres. On plotting and sectioning these to scale, it will be found, as we have before explained, that the old Palæozoic surface, now underground, is less disturbed and goes deeper (though not immediately) as it recedes from the outcrop on the northern flank of the Ardennes, and goes northward and westward, and, moreover, that *no coal exists* at any of these points to the northward of the known productive fields; the borings are so close together (we could quote several others) that this important point is definitely settled. We could show that the same phenomena are presented in Eastern Belgium with reference to the Liège field.

Now to approach the Valenciennes coal-field, for this is a further connecting-link with our own beds, being nearer to them than the Mons area. The field of Valenciennes thins out, and the coal deteriorates so much that at Bethune it is a mere narrow wedge. In coming nearer the Channel, this poor narrow zone is flanked to the north and south by Devonian rocks, which occur just under the chalk. A "Carte Industrielle du Bassin houiller du Nord de la France" was prepared for the Compagnie de Vicogne, showing numerous fruitless trial-bores by speculators. In face of these facts, Sir Roderick Murchison stated his belief that success would not crown any efforts in search of coal on this side of the Straits of Dover; and this argument is so potent that hardly anything short of the actual discovery of a coal-field in Kent or adjacent counties can materially affect it. There seems no doubt whatever, from the continental evidence, that the middle and lower Palæozoic rocks serve to connect the Ardennes axis with the Somerset axis and basin, but the probability of the coal-measures lying on them, or being caught up in folds or inversions underground in the south-east of England, is rather small. The evidence of the London basin borings alluded to, is painfully similar to that obtainable from those cited as executed to the north of the productive fields in South Belgium. There is just a bare possibility of a small independent coal-field existing under parts of our south-eastern counties, but that is all; the evidence at present in support of this theory, as we have seen, is not very encouraging.

Meanwhile, Sir Edward Watkin must, of course, follow up the discovery by going on with the work, and we hope that the diameter of the bore-hole is sufficient to enable him to thoroughly probe the matter. Other trial bores are, no doubt, contemplated, and we would suggest that a more favourable result might be obtained by sinking them about ten miles west-south-west of the Channel Tunnel site. The lower Secondary beds will probably be a little thicker there; but the main reason for the suggestion is that the site is more on the line of strike of the Carboniferous beds in the Boulonnais at Ferques, Leulinghen, Locquinghen, and Hardinghen, than is the Channel Tunnel site. This latter seems rather too much to the eastward, and, assuming extension of the coal-measures from the Boulonnais, the seam at present discovered would merely be a representative of the thin northern flank of the field, instead of the thicker and best part of it, which we believe (under the assumption) would be found at the spot at which we suggest a further experiment being made.

In the meantime, it is to be hoped that both public spirit and private enterprise will raise sufficient funds to definitely prove or disprove the existence of the coal-field. The necessities of a practical and progressive nation will then decide whether or not it is wrong to turn Kent into "heaps of coke," and increase our incomes "sixtyfold instead of fourfold," in face of the maledictions of Ruskinian sentimentalists.

## A HISTORY OF CROMER.*

THE interest recently felt in Cromer through its rehabilitation as a fashionable watering-place, coupled with a desire to do something for the fund for the restoration of the church, seem conjointly to have inspired Mr. Rye with the idea of putting some information as to the history of the place into a handsome quarto volume, printed on special and thick paper and with margins of monumental spaciousness. There is much to be said and learned about the town and district, we surmise, other than what is here included; but the volume contains enough information, apparently trustworthy and carefully prepared, to satisfy those who are not professed archæologists, and ought to prove of some interest to the many persons who now throng to the decayed little Norfolk coast town for their autumn change and holiday.

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* Cromer, Past and Present; or, an attempt to describe the Parishes of Cromer and Shipden, and to narrate their history. By Walter Rye. Printed for the benefit of the funds for the restoration of Cromer Church. Jarrold & Sons, Norwich and London; 1889.

"Decayed" may be thought a mistaken word to apply to a town which has not many years since had a new railway run to it, besides the more recent local line ending at "Cromer Beach" terminus, and which has built various new terraces and is entering for the first time on the dignity of a town hall, the new building for which is illustrated in this number. But Mr. Rye,—who, though he dates his preface from Putney, appears from various patronymics in the book to be either in person or in family an old Cromerite—observes that at the present moment the town has absolutely no sort of trade except that one of looking after the comfort and pockets of visitors, which goes on so briskly for about two months out of the twelve. Shipden or Schipeden, which was once the main portion of the town, lies under the sea, and a steamer was wrecked on what was said to be the remains of its church walls the year before last, and which are occasionally visible above water, though not as the author says, "at neap tides," but at low water at spring tides, which is when the tide is lowest.*

> "To understand what Cromer was like three or four hundred years ago, one must picture to oneself a great cliff standing much more out to sea than at present, and under it a real harbour with a heavy-timbered pier-head like that now at Gorleston, with rough stone walls clumsily contrived and repaired now and again in an obstinate English fashion, as the incoming sea cut them away from time to time. Quite a fleet of trading-ships and fishing-boats lazily tossing about within the harbour, and a large fish-curing and outfitting population busy on the shore, —in fact as different a spot from the quiet watering-place of the present day as can well be conceived."

And what was the great spacious church of Cromer built for, with its massive and richly decorated tower, save for a place where many went out and in—for something much more of a town, we may be sure, than now clusters about the two or three little winding lanes which form all that is left of the streets of the old town. In 1358, the author tells us, the "merchants of Cromer" are mentioned (he does not say in what document). He also notes the theory that Cromer is really the buried part of the town and Shipden the present Cromer, for which there seems to be some evidence of a doubtful and uncertain character. In 1425 the place is referred to as "Shipden by Cromer": the form "Shipden *alias* Cromer" begins about 1452, and the name of Shipden by itself falls out about 1483, but "Cromer *alias* Shipden" is found for many years afterwards.

The chapter on "The Old Trades and Townsmen" contains much that is interesting, especially in the glimpse we get through old letters and other documents of the constant struggle to keep up the port and make things good against the inroads of the sea. 1551 was a bad year. "Not only had 'the rages and surges of the sea' swallowed up and drowned a number of the great sort of houses, but a great part of the town had by negligence of certain persons been consumed by sudden fire, so that by the length of a whole street it was still not rebuilt;" and a petition for relief was sent up to the Government, with what result does not appear. In the seventeenth century Cromer and the neighbouring coast received a good deal of disagreeable attention from pirates of various kinds, and there was such a chronic state of alarm on the subject that in 1623 Taylor, "the water poet," and his companions, making an innocent boating excursion round the coast and landing at Cromer, were taken in charge on suspicion, their boat considerably damaged, and themselves kept in durance vile till some leading gentlemen of the neighbourhood could be summoned to examine them; who quickly understood the truth, and Sir Austin Palgrave offered them the hospitality of his house a few miles off, where no doubt they ended with a merry evening. The whimsical poem in which Taylor relates the adventure, and satirises the absurd alarm and cowardice of the townfolk, is quoted in full, and is in its way very amusing reading. Taylor at the close of the poem heaps coals of fire on the heads of his persecutors by making an appeal to public sympathy in regard to the perilous condition of the town, not from pirates, but from the sea:—

"It is an ancient market-town that stands
Upon a lofty cliff of mouldering sands;
The sea against the cliff doth daily beat,
And every tide into the land doth eat.
The town is poor, unable by expense,
Against the raging sea to make defence;
And every day it eateth further in,
Still waiting, washing down the land doth win,
That if some course be not ta'en speedily,
The town's in danger in the sea to be.
A goodly church stands on these brittle grounds,
Not many fairer in Great Britain's bounds;
And if the sea shall swallow it as some fear,
'Tis not ten thousand pounds the like could rear.
No Christian can behold it but with grief,
And with my heart I wish them quick relief.
So farewell Cromer, I have spoke for thee,
Though you did'st much unkindly deal with me."

The present Cromer lighthouse, with its powerful revolving light, well known to visitors as a conspicuous object on the highest point of the fine down between Cromer and Overstrand, was built well inland in consequence of the fate which befell the old one, which it appears was still standing, an old brick circular tower, on the then verge of the cliff, in 1866, "when it slipped into the sea silently one night"; a fate which will probably also before many years befall the old abandoned circular church tower of Sidestrand, three miles eastward, of which a sketch was given in the *Builder* of Sept. 24, 1887.

The book having been produced mainly with the intention of aiding the church restoration fund by its sale, Cromer church naturally occupies a considerable space in it, and is well described historically and architecturally, and illustrated by many engravings of various curious and interesting bits of detail. From this chapter we learn that the recent state of utter ruin of the chancel was consummated by deliberate destruction, in order to save the expense of repairing it; an order for the demolition, for that stated reason, having been given by "Antony, by divine permission Bishop of Norwich," in 1681, and for building up the ends of the nave and aisles with walls. The author adds: "The work of demolition is said to have been completed by gunpowder (I sincerely wish the reverend gentleman had been seated on the mine at the time of its explosion), and the rood screen and loft, if not already down, must have been sacrificed when the chancel arch was blocked up. . . . It was reserved for the authorities in 1840 to put the finishing touch to a century and a half of vandalism; for, to obtain 540 extra sittings, they pulled down the west gallery, and not only built it up again, which was bad enough, but erected two others along the aisles, which was worse." All these were removed in the first restoration some years since, and there is now a grand open lofty nave, a little marred by the rather too slender proportions and poor mouldings of the piers, but the general effect is fine, especially when seen filled with the crowded congregation which musters in the autumn season. The next thing wanted, when the chancel is paid for, is an organ in proportion to the scale of the building, instead of the wheezy little instrument (opened by Beckwith of Norwich, in 1792) which stands in a corner of the nave, and is fairly drowned by the psalm-singing of the congregation.

The restoration of the nave was carried out under the direction of Mr. Brown of Norwich, and by a local builder, Mr. Newman, and seems to have been very well and carefully done internally, and in a very conservative spirit as regards the exterior. The author observes, "the present restoration is supervised by Mr. Blomfield, and the builders are strangers to these parts, which is a pity." Mr. Rye is evidently a Home Ruler in these matters, and makes one or two other hits at the impropriety, as it appears to him, of having engaged an architect from a distance, instead of one native to the country and acquainted with the local type of flint building; but as he does not appear to be able to lay his finger on any tangible error on Sir Arthur Blomfield's part, we may regard this as only the general grumble of a writer with strong local sympathies. He has however, in spite of these feelings, produced the book before us as a contribution towards the cost of the chancel restoration, and whether or not it has been successful in that respect, it is at all events a record which many of those who know and love the place may be glad to possess.

## NOTES.

We have said so much concerning the Forth Bridge at various stages of its progress that it is hardly necessary now to recapitulate its history, or to do more than offer our congratulations to those most nearly concerned on the successful completion of one of the greatest and boldest engineering projects in the history of the world. Whether the construction of the bridge will repay in a financial sense the outlay upon it may be doubtful, but we are disposed to agree with the opinion we have already seen expressed, that it was worth doing for the sake of glory, and the exhibition of the power of modern engineering to cope with great natural obstacles. Sir John Fowler, we are glad to see, is to be created a Baronet, and Mr. Baker a Knight Commander of the Order of St. Michael and St. George, and Mr. Arrol, the contractor, will be knighted. No one will dispute that all the honours are well earned, far better than some of the similar honours that are bestowed as mere political rewards. Sir John Fowler in his speech at the luncheon did not forget to say a word for the workmen, who as a body deserve all recognition for the courage as well as skill which they have exhibited in carrying out this difficult and risky work. To say that "not one of them had ever knowingly scamped a rivet" may be hardly in accordance with things we have both heard and seen in the progress of the work; but this we suppose is an occasion on which "omnes omnia bona dicere" is a kind of accepted understanding.

We feel little doubt that the cause of the dreadful railway accident at Carlisle is that which has nearly caused other accidents before now, and which we have always expected would bring about a fatal accident sooner or later: viz., the habit of trusting to the power of the continuous brake over a whole train to pull up in a much shorter space than was formerly necessary, and thereby endeavouring to save time by running fast up to a station and pulling up quickly. This system, to begin with, greatly interferes with the comfort of railway travelling by shaking and jerking the train much more in stoppage than used to be the case; but it is also a constant source of possible danger, which this time seems to have had its effect. The old hand-brakes on tender and guard's van required a considerable distance to pull up a fast train, but they were simple levers which, if examined immediately before starting (as was always the rule on all well-managed railways), might be safely depended on to do their work. The continuous brakes of various kinds, now in use, are much more complicated machines, giving no doubt an immensely-increased chance of safety in an emergency, but also liable to fail occasionally when absolutely wanted. The inquest may elicit some other or additional reason for the accident; but on the face of the facts as so far stated we have little doubt that the real moral of the accident is that engine-drivers should be peremptorily required to allow longer distance for pulling up, regarding the continuous brake not as a means of regularly pulling up sharp, but as a provision for emergency. Unless this is enforced we shall have other accidents of the same kind.

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* It is curious how widespread is this popular error that neap tides are the lowest of all. The high tide is lower at neap than at spring, but the low tide is not so low: in other words, the rise and fall in reference to normal level is less.

MR. STANHOPE'S statement in the House of Commons last week, in moving a resolution preparatory to the introduction of his Bill in regard to barracks and the accommodation of troops, must be regarded with mingled mortification and satisfaction, for it is evident from the speech of the Secretary of War that the sanitary state of our barracks has been thoroughly unsatisfactory, and that the progress in sanitary matters, which has generally been noticeable all over the Kingdom, has not taken place in those buildings which are set apart for the accommodation of our troops. The blame for this must be placed on several shoulders: on those who have been at the head of the War Office, on persons in charge of troops at insanitary barracks, and on the country at large, who have preferred to save their money rather than improve the health of their troops: but, of course, the chief blame rests on the Secretary of War, who is morally and officially responsible to the country for the health of its troops. A more naïve and unstatesmanlike confession than that of Mr. Campbell-Bannerman, who had been Secretary of War to the late Government, could not have been made; for he stated that he was well aware that the housing of the troops of this country was in a most unsatisfactory state, and had been so "for a series of years." It was, in fact, a confession of official incompetence. Again, Mr. Stanhope stated that so long ago as 1859 the Commission on Barracks and Hospitals reported as to the Galway Barracks "that they are amongst the very worst specimens of public establishments we have ever seen." Yet thirty years have elapsed, and we are only now going to carry out the recommendation of that Commission. But of past mistakes and oversights it profits little to speak; we are now more concerned with the effective improvements of the future. At the same time it is necessary to point out that it will not be sufficient to remedy defects in some places only; the whole barrack accommodation of the United Kingdom and abroad must be overhauled. We say this because in Mr. Stanhope's statement no mention was made of Scotland, and of only four foreign stations; and we can have little doubt that there are blots to be found in other places.

WITH the military details of the scheme above referred to we are not concerned, but, as regards the other parts of it, Mr. Stanhope's statements seem to be fairly satisfactory. As he is going to ask the country to spend over 4,000,000 of money, he has not been satisfied with the opinions of his official advisers. He has consulted "a contractor high in his profession," and Mr. Pilkington, who has had "enormous experience in planning industrial dwellings," who are satisfied with the proposed manner in which the work is to be done. It would have been more satisfactory to the public, however, if the name of this contractor had been stated, and a consultative committee of two or three architects would have had more weight than the opinion of one. It is satisfactory, however, to find that a Sanitary Committee is to be established to supervise the sanitary part of the scheme, and also, in the future, to examine the reports of the sanitary state of the barracks received both at home and abroad; and to make recommendations thereon to the Secretary of State for War; but our satisfaction is somewhat damped on this point when we bear in mind how many reports are made which responsible officials do not act upon, and we have a glaring instance of this in regard to the Galway Barracks, which we have just mentioned. It is unnecessary to particularise the new barracks which are to be built,—which, indeed, Mr. Stanhope did not do fully. There are to be new barracks at Dublin and somewhere outside of Manchester, also at Portsmouth, Enniskillen, and at Malta. The question is yet in a preliminary stage, and as further details are made public it will, no doubt, be necessary to refer to it from time to time. For the present it is sufficient to congratulate the country on the probability that within the next two or three years its troops will be housed as for a long time it has accommodated its paupers, lunatics, and criminals.

THE new edition of the Post Office Guide is far more true to its name than has been the case with previous issues. Not that these have been deficient in information, varied and valuable, but the meaning of some of it was so obscured by "signs and wonders" that only an expert could show the interpretation thereof. These remarks apply more especially to the particulars of the despatch and delivery of mails to and from London, which are now set out most distinctly. Hitherto they have been expressed in a mysterious manner by means of letters and figures (in and out of brackets), the seeker for information on these points being confronted by something closely resembling an algebraic problem. Now, the time of despatch of each mail to and from all the principal offices in the three kingdoms is shown in one column, and the approximate time of delivery in another. This information occupies nearly a hundred pages, in lieu of the half-score pages into which it was before compressed, and is followed by the regulations relating especially to the London district. The latter still presents a somewhat complicated appearance, but is very full and complete, and is set out in a more uniform manner than before. It will be remembered that the January edition of the Guide was burnt at the printers' just as it was ready for delivery; and if Mr. Raikes had all this new matter ready for the New Year's issue, it must have been particularly annoying to him to have had the whole edition destroyed. We notice that the Telegraph Money Order system is now to be extended to all offices transacting Telegraph and Money Order business, so that the experiment,—which has hitherto only been in force between about a dozen places,—has, presumably, been successful.

THE eighth exhibition of the Society of Painter-Etchers at the rooms of the Society of Water-colours is an excellent one as a whole, and contains some works of special character and power. In an architectural journal mention should perhaps be made first of the highly worked and magnificent etchings of buildings by Mr. H. A. Haig, especially the interior of Burgos Cathedral (16), as remarkable for the accuracy and care with which the architectural detail is shown as for the brilliant effect of light and shadow that is realised. There are few architectural etchers who combine breadth of effect with correctness and clearness of detail as we see it here; though it may perhaps be said that the work still remains essentially an architectural drawing, with a certain degree of the artistic limitation suggested by the phrase. "The Patio of the Cloisters, Burgos" (45), is another fine work of the same class. Mr. Slocombe contributes also some large architectural subjects in a somewhat freer and less finished manner (more suitable perhaps for etching), such as "A Canal at Bruges" (91). We should not forget Mr. Haig's fine view of "The Two Bridges, Cuenca" (123), the subject being a remarkably effective one, the contrast of the little half-ruined bridge below and the towering arches of the aqueduct rising above it. In regard to etching, however, our sympathies are much more with the slighter and more freely executed works, which show a great deal by a few lines, which is the special power of etching. Among the best of this class are some of Mr. Frank Short's small works. "A Wintry Blast on the Stourbridge Canal" (20), a dry-point, is quite a little poem in copper-scratching, so bleak and wind-driven is the effect of the whole. Mr. Hugh Paton's "Gourock" (11), Mr. Wilfrid Ball's "After Sundown, Venice" (12), Mr. Percy Robertson's "Wet Day, Whitby" (107), Mr. F. Short's "Low Tide, The Evening Star, and Rye's Long Pier Deserted" (97) are other examples of the same kind of work, where "more is meant than meets the eye." Among works aiming at special effects the "Music Party on the Grand Canal, Venice" (114), by Mr. T. C. Farrer, is a remarkable attempt to realise moonlight effect in an etching on a large scale, and very striking and powerful in effect and manner of execution. Among the special things of the exhibition are the strange figure studies by Mr. William Strang; some of them, as "The End" (249) and "A Soup Kitchen" (52) are perhaps as repulsive as they are original; but the one called "Taking the Oath" (34) is a most remarkable study of character in the various heads. Of the original genius of this artist there can be no doubt; it is to be hoped he will not allow it to degenerate into eccentricity, which seems to be rather his danger. A considerable loan collection of Rembrandt's etchings adds another special interest to this year's exhibition.

PARIS GARDEN, known as the King's manor, as appertaining to its lord and copyholders, formerly lay in St. Saviour's parish, and was famed for its mill, water-courses, pastures, and wild plants. In 1670 nearly all of it was taken for the new parish of Christchurch, as constituted under the will of John Marshall, who had died forty years before. Comprising the ancient hide of Wideflete, and covering nearly 100 acres, it had been given in 1113 by one Robert Marmion to the Cluniac monastery at Bermondsey, whence, about fifty years later, it passed to the Knights Templar, who set up a chapelry there, and from them to the Knights Hospitaller of St. John. In the early years of the fifteenth century it became a sanctuary for offenders. Ultimately passing to Henry VIII., it was granted as dowry for Jane Seymour. Lord Hunsdon and others, who got the manor from Queen Elizabeth, conveyed the land and manor-house to Thomas Cure, a benefactor to the parish. The manor-house has been identified with the Holland's Leaguer, or Nob's Island, one of the many houses of ill-fame that formerly flourished on Bankside. The moated and castellated "Leaguer," which was kept by one Susan Holland, in 1630, and is illustrated in Wilkinson's "Londina," stood south-westwards of the present Falcon drawing dock. Latterly known as Beggars' Hall, it was pulled down in making the southern approach to Blackfriars Bridge; yet some authorities question the survival of the original building to that time. The Wideflеet was converted into a sewer, having its outlet by the Barge House-stairs. In a fine bird's-eye view of Bankside, *temp.* Elizabeth, are shown "Gravil-lane [now an arm of Holland-street] leading to St. George's-felds" (of which the site has lately been taken for widening the railway bridge); the "Olde Parris Garden-lane, running from the Cross to the river-side; the way leading to the Manner-house; "Oulde Parris Garden"; together with Wideflete Mill and the mill-pond, southwards of the once famous "Folken Ine in the Clincke Libertie." Gravel-lane is marked in Horwood's large-scale map as the parish eastern boundary. The mill-pond lay at the elbow of Holland-street.

TWO tenements in Gravel-lane, Southwark, a cottage in White Hart-court, and a plot of land in Broadwall, Stamford-street, Lambeth, were yesterday put up for sale at the Mart. This small property, which is free from quit-rents or fines, is noteworthy as being copyhold of the old Paris Garden Manor, whereof a small slip,—latterly Cuper's Gardens,—yet remains, in position at least, in the public recreation-ground at the southern foot of Blackfriars Bridge. In his "Glossographia" (1681), Blount derives the name of this Manor from one Robert de Paris, *temp.* Richard II. A Close Roll, 15 Rich. II., relates to an order by that Sovereign that London butchers should carry their garbage and offal to a place "juxta domum Roberti de Parys," whence, it appears, the residuum was to be cast into the river. Mr. W. Rendle, the eminent Southwark antiquarian, has stated that he is "inclined to think the Manor may have been first known as Parish or Parysh Garden, becoming at length, about the time of Henry VIII. and Edward VI., Paris Garden, or, indifferently as it was spelt, Paris or Parish." He cites a record of 1420 wherein it appears as Parish Garden; and from another, of fourteen years later,—"Molendina de Wideflete cum Gardino, &c.: vocato Parishgardin."*

SOME stained glass which is shortly to be fixed in the great west window of St. John's, Chester, given as a Jubilee Memorial by the Duke of Westminster, has been on view at Mr. E. Frampton's studio. There are three lights filled with figure subjects (numbering twelve in all) dealing with the history of the city and church, and divided from each other by bands of grisaille. Heraldic work has been introduced at the base of each light and on the grisaille work, the shields in the former position bearing the Royal Arms and those of the donor and his wife; while the latter have the arms of the Mayors. The church itself figures in several of the subjects, the warm red sandstone forming a suitable background. Altogether, the contrast between the white of the grisaille and the rich colouring of the figure-subjects seems likely to give a fine effect when fixed, although it is impossible to judge fairly of its effect as seen in the studio in London. The success, however, of the Blake Memorial at St. Margaret's, Westminster, augurs well for this latest addition to St. John's at Chester. The window is to be fixed shortly, and dedicated on Easter Eve.

THE newly-worked marble quarries at Saalburg promise, at a period not far hence, to be the largest of their kind in Germany. The stone-bed, which is of enormous extent, and will take centuries to exhaust, gives a stone of excellent durability as well as of very fine colouring. The works are in good hands, and extensions and improvements are continually being made on a large scale.

ON February 17 a paper on "London Docks and their Construction" was read by Herr Garbe before a company of about eighty members of the "Architekten-verein" of Berlin. Special note was taken of the construction of the sides, lock-walls, &c., of the more modern docks in "beton"; and the lecturer strongly advised the use of this material for similar works in Germany.

THE President of the Union at Oxford has appealed to the life-members, says the *Academy*, for subscriptions to a fund of 2,000*l*. for putting the buildings into thorough repair. The Society's rooms lie between the Corn Market and New Inn Hall, lately incorporated with Balliol College. To this site, since enlarged at various times, the original "Debating Society" removed in 1852. A room for debates was built about four years later; and this in turn was replaced with a larger room, constructed of brick with stone dressings, after the designs of Mr. Waterhouse. The former debating-room was converted into a library. Its frescoes, by Burne Jones, Rossetti, and other artists, are, we are informed, in a sadly decayed condition. The block of buildings comprises, also, the keeper's apartments, a smaller library, a writing-room, newspaper and magazine rooms, lavatories, &c. Our contemporary hints that these attractions are somewhat weakened by the recent luxurious provision on the part of the several college authorities of libraries and undergraduates' common-rooms, together with the increase of various clubs and kindred associations amongst the students themselves.

THE exhibition of pictures of Japan by Mr. Alfred East, at the Fine Art Society's Gallery, is interesting both in an artistic and topographical sense. Mr. East is an artist with a great power of rendering effects of light and colour in landscape, and has produced a number of drawings of great beauty and interest from this point of view, while conveying also a strong impression of reality of representation; and those who have not visited Japan gather from the collection an impression of knowing a good deal more of the character of the landscape and village scenes of the country than before. The village street half covered with umbrellas put down open to dry after a rainstorm (96) is a very characteristic bit of local effect. Among the larger landscapes is a very fine view of Fuji-San (as we are now told to call the mountain) in early morning (22); two scenes showing peculiar effects of light on Lake Biwa (14, 18); "A moist day in a paddy-field" (21), with the white egrets like flying flecks of sunlight over it; "Lotus flowers" (34) and "Lotus pond" (42), the latter a fine study of the crowd of flowers with great leaves expanded in the bright sunlight. "An angry night" (60) is a small but interesting study of a peculiar effect of dull red sky under a roof of dark clouds. The largest painting, "Dawn on the Sacred Mountain" (69) is perhaps not so entirely successful as some of the smaller landscapes, but it is an ambitious and in many respects a fine work.

AN Architectural Students' Association has just been formed in Sunderland, the stated object being, according to the wording of its second Rule, "to provide union among its members, the elevation of the profession of architecture, the general advancement of the study of the art and science of architecture, and the guiding the studies of the members to qualify themselves to pass the progressive examination of the R.I.B.A." This is a step in the right direction, which we hope will be followed by other towns which have not as yet any such Association. The formation of provincial Associations with the special object of working up to the programme of the Institute of Architects is one of the best practical methods of promoting both unity and an adequate educational standard in the profession of architecture.

## ROMAN ARCHITECTURE.*

By Professor Aitchison, A.R.A.

THE subjects I have touched on in the preceding lectures are so vast in extent that many courses of lectures might be given on each one, but I thought it would be more useful to devote this last lecture to some general remarks on Architecture, and to a reasoned abstract of the preceding subjects, than to add fresh matter.

Classical archæology is a fascinating study, as it brings more visibly before us the ways of those from whom we have received the bulk of our civilisation, it opens our eyes to the knowledge we have gained since those times, and also to what we have lost, for, to speak of nothing else, the perfection of form and dignity attained by the ancients has never since been equalled.

We cannot doubt that Vitruvius was acquainted with the canons of Greek art, nor that he has given them in that modified form in which they were used by the Roman architects of his day. We have at least learned from Vitruvius the method of proportioning the parts and disposition of an order by means of the module, and we know that the proportions adopted by the ancient Romans in their orders have been universally approved by mankind ever since, or at least at the most cultivated epochs.

Through Vitruvius architects have not only been impressed with the importance of obtaining harmonic proportions in their buildings, but they have admitted, by constantly seeking such proportions, that to such proportions the æsthetic part of architecture is mainly due. We cannot doubt that these views were adopted by the Gothic architects, when we have Cæsariano's scheme for properly proportioning the plan as well as the elevation of a Gothic cathedral. When an accomplished architect says of a building that it is disproportioned, or ill-proportioned, he cannot express a more severe condemnation.

Besides knowing the rules, we want so to educate our eyes to good proportion, that we cannot endure anything ill-proportioned coming from our hands. We should emulate Michael Angelo, and have our compasses in our eye. If my contention be admitted, can any study be more important than that of the antique for training our eye to good proportion?

Unfortunately, most of the ancient Roman buildings are in ruins, so that we can get but little else than the proportions of their plans; but when complete parts still remain, as in the Baths, though stripped of all ornament, we cannot fail to be struck with their majestic proportion.

All must admit that the effect of the Pantheon is unsurpassed, and in this case we have the original building almost complete.

Little more than half a century ago classical archæology was nearly all that was taught, because it was nearly all that was wanted, and even now, according to V. le Duc, architecture is but archæology. Still, I think we are now in a somewhat different position; there has been a Gothic irruption since in the way of art, and an engineering irruption in the way of science, and both have modified our views on art. As regards science, the ancients are mere children by the side of our contemporaries; the 1,300 ft. span of the Forth Bridge makes the Pantheon, with its 142 ft. diameter, and the Basilica of Maxentius with its 80 ft. span, look like toys. The Pantheon has, however, stood for 1,900 years, and affects the cultivated visitor of to-day very much as it may have affected a cultivated Roman in the days of Agrippa; while the bridge is but to meet a temporary want.

Though we are so near to Gothic days in point of time, and so far from those of Greece and Rome, yet as regards the main features of our civilisation, and as regards our feelings, thoughts, and habits, the position is reversed. With the fortunate exceptions of our having no slaves and not living on plunder, the Roman manners, customs, and ways of thought are very like our own; we fancy in our reading we are talking or listening to English gentlemen, until we come across some horrible trait of cruelty or inhumanity that almost makes our hair stand on end, but of which the Roman writers thought nothing. Martial mentions, in the lightest way, that at the ensuing games the episode of Mutius Scævola before Porsenna is to be acted, and the slave who acts Scævola will burn his right hand off. He remarks that this appears to be a very courageous act, but it is not so, for if he does not do it, he will be put in a pitched dress, and burnt alive.

We sympathise more with what is dignified, graceful, and refined than with what is wonderful and full of savage energy, but wholly wanting in grace and subtle proportion.

Geologists, I believe, draw a line between the condition of the earth before and after the Flood; our line of demarcation as regards a part of our thoughts and habits is drawn at the perfecting of the steam-engine by James Watt. In certain respects the world has been revolutionised by it and our habits, and partly our thoughts, have been revolutionised too. Shortly after the perfection of the steam-engine came the French Revolution, and that has produced a different state of feeling between man and man. There is, in consequence, a certain chaos of feeling on the disparity of the position this age holds in respect to the world behind it among all educated Englishmen, and probably in all Christendom. In certain material directions the old world has almost a ridiculous and contemptible air; time as regards space had not then been annihilated, and work had to be done slowly and laboriously. Ulysses smoothing his door-posts with a bronze adze is almost ludicrous, when we could get them better done in a few minutes by a planing machine; but who amongst us can compare with him in simplicity and dignity? The bulk of a Doric column of the Greeks is ludicrously excessive from a material point of view, but a 4-in. cast-iron column does not raise in any mind a feeling of sublimity and delight. We are, as it were, dragged in two directions; we are elated by the magnificent material achievements of our contemporaries and immediate predecessors, and we are humiliated and depressed by the superiority of the ancient thinkers, writers, and artists.

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* *Vide* "The Antiquarian Magazine and Bibliographer," June, 1885.

* Being the sixth and concluding Royal Academy lecture on Architecture this session. Delivered on Thursday, February 13. (For the five previous lectures, see the *Builder* for February 1, 8, 15, 22, and March 1 respectively.)

Homer probably appears to us even grander and more unapproachable than he did to his contemporaries. The late James Fergusson was always in a state of indignation because the contemporaries of the inventors of the railway, the steamboat, the telegraph, and steam printing, were not better poets, painters, sculptors, and architects than the Greeks; he was convinced that it was merely due to indolence and wrongheadedness, and from the numerous utterances of the day you may see that this opinion is common.

If there is no poetic feeling at any particular epoch in a nation, there is no poet. If a figure-painter finds no paintable subject of the present time, he falls back on Greek, Roman, or Biblical times. A sculptor can have angels, gods, goddesses, or heroes; he is not confined to swallow-tail coats, chimney-pot hats, and glazed leather boots; but there must generally be new buildings actually fitted to the requirements and exigencies of the present day, and though most people do not care a straw about architecture, they execrate architects, because they do not happen to live in a fine-art epoch. Every despot would like his age to be an eloquent one, forgetting that persuasion or demonstration is useless when he can do what he likes, and that he may even punish plain out-spokenness with imprisonment or death. You cannot have what you want when that want is merely produced by vanity. You must have the requisite preliminaries, cultivation, surroundings, and admiration before you can get what you say you want. People, as a rule, say they want a new style of architecture. What do they do to get it? Let us take music as a thing people do want: what do they do to get first-rate music? At least one-half of the population above the lowest class, the fairer half, learn it from their childhood. A great part of the male half profess to like it, and often hear some, and a few, outside professional musicians, study it. The encouragement of successful musicians, in a pecuniary sense, is splendid, and the enthusiasm not only exhibited but felt, is unbounded; whether the higher gifts of the composers are equally well remunerated and admired, I do not know.

Most educated people know the difference between a Classic and a Gothic building when they see them, and that is usually the beginning and end of their knowledge. They praise St. Paul's and Westminster Abbey, just as they praise Milton and Shakspeare, because it is the fashion, though they have probably never read the former and have only seen some of the plays of the latter acted. On how few modern buildings do they cast an eye or bestow a thought, for the purpose of appraising their merits or enjoying their beauties; how many passers in Pall Mall stop to admire the Reform Club, and thank God that England produced such a genius as Barry?

Before you can make the first step towards a new style there must be something with which the public is taken; the public must have some strong desire towards one form rather than towards another, or there must be some new structural necessity for some new form, and it must insist on this new form being made beautiful in the way it desires; but as far as I can see there is no more inclination towards one particular form than towards another, and there is no unanimous desire for any particular form of beauty. Directly such a taste showed itself the architects would follow, and then there would be a development; but until such a concurrence of taste exists, it seems to me impossible for a new style to arise; and be it observed that most new styles, except Byzantine, have been created by nations just emerging from barbarism.

Each architect now paraphrases what he likes best,—Greek, Roman, Early or Late Italian Renaissance; French, German, Dutch, Flemish, or Scandinavian Renaissance; Elizabethan, or the various phases of Byzantine, Romanesque, Gothic, and Saracenic.

Great skill in planning, considerable invention, and great taste is often shown in our new buildings; in fact, London is fast becoming the most picturesque modern city in the world; but until there is a concurrence of taste in the public, there can hardly be a concurrence of aim in the architects.

Before this unanimity of taste can take place, the people must love architecture, have some knowledge of its laws, and have a strong desire to get their views carried out, and be as thankful to the architects who can thus raise their emotions as they are to poets.

It is the admiration of his contemporaries that is the greatest spur to the unwearied striving of the genius, be that genius in what line you please. Next below this, the most desirable things are praise, honour, and wealth. Did any one ever hear of an architect getting anything but abuse? I believe there is only one architectural knight in England, and there are not ten men in London who make a decent living out of architecture. I now speak of those who can make a living out of designing buildings combining beauty with utility, and I do not include the measurers, valuers, surveyors, land and house agents, nor those who build for utility only, without regard to shapeliness.

Architects are not exempt from the effects of the wonders that are being created around them; the faint breathings of the past revolution still stirs their veins, and there are signs of a new one:—

> "Slowly comes a hungry people, as a lion, creeping nigher,
> Glares at one that nods and winks behind a slowly dying fire."
> Tennyson—"Locksley Hall."

They, too, want to surpass the past, to stamp their works with the expression of the age, and, if possible, to start such new modifications in architecture as may eventually become a new style; but the question is, how any one of these objects is to be compassed? The age is an inartistic one, where the highest intellects are wholly set on conquering physical difficulties, on superseding human labour, and on the investigation of the laws of Nature—an age which looks on all the arts, and particularly the architectural one, in the same light that Sir Isaac Newton looked on poetry, as "ingenious nonsense." Much of the building that is done, and much that will be done, must in its main features greatly resemble the past; it will be in stone, in brick, in concrete, in wood, or in lath and plaster. There must be columns and piers, colonnades and arcades, and walls with openings. The openings must be square or oblong, round or oval, with flat, round, elliptical, or pointed tops, and there must be roofs or terraces. The architects should stamp their buildings with the tastes of the day—only, unfortunately, there are none. Directly there is an insistance on buildings being beautiful (and of a new kind of beauty), there is a hope in iron, for iron buildings do now occasionally occur, and must occur more frequently in the future, and there are no examples of iron buildings in the world.

The question is, How are we best to prepare ourselves for the inevitable changes that must take place? Of one thing I am sure, that there can be no improvement so long as men think that any man, any people, or any age has done that which cannot be surpassed, and that all that can be done is to imitate that work. Yet the sole method of surpassing the best that has been, is to imitate it and to paraphrase it, until we can do as well ourselves, and then to advance beyond it.

Since the Egyptians, there have been no such great builders as the Romans, and they, being the masters of a good part of the world known to the ancients, wanted grand public buildings in every large city of their dominions. Consequently, there was a school, or probably many schools, for such buildings; here there is only occasion for two or three in a century.

Even three great public buildings in a century might give much aid to young architects, and to the foremen and workmen employed, they would be schools of architecture if they were in one style, and that style was the chosen one of the people, and by this I mean if the people had developed taste and liking enough in one particular direction; but if one of these public buildings is Classic Roman, another Gothic, and another Early Italian Renaissance, you get no concurrence of opinion and effort, and no means of comparison. There is, too, another consideration—the buildings should be such that the best paintings and sculpture of the present day will harmonise with them. This cannot be the case with Gothic. The best painters and sculptors will put in their best work, but then their work is incongruous with the building; the modern Gothic architects feel this, and when they can, force inferior artists to imitate Gothic images and Gothic daubing.

Considering that our practice is mainly confined to mansions and private houses, I thought that some notion of the Roman mansions and houses must be both interesting and useful.

Rome itself was in a sunny climate, and all its southern and eastern possessions were in still warmer climates. Shade was wanted, which was procured by porticoes, and porticoes require columns, and nothing is more beautiful than well-designed porticoes in a sunny climate, with the alternation of bright light and deep shadow. But here, in this misty climate, and in this sooty air, the columns and the shade between them are nearly alike for a great part of the year. Here, it is true, we want shelter, but we also want light, and porticoes are usually most disastrous adjuncts to public buildings, except as porticoes to churches, for they darken the interiors.

One would judge England to be a very poor country, for the niches and pedestals of our public buildings are still without their statues and groups. Remember the three thousand bronze statues Scaurus had in his theatre, which was only a temporary one for a month or two's use; and gem engraving is almost extinct, as well as the making of artistic plate. Yet if we can keep up our courage, our vigour of mind and body, our industry and invention, our integrity and virtue, England will gradually become rich, and as wealth is what is saved by self-denial from the surplus industry of mankind, the gaining and preserving it are certainly virtues. Riches themselves, if properly used, seem to me to be an undoubted advantage. As Dr. Johnson so wisely remarked, there have been many treatises on the advantages of poverty, but none on the advantages of riches, as these are self-evident. If we will but use these riches, when we get them, wisely, there is no reason why England should fall; that is if wisdom, courage, temperance, and justice still remain with us.

I think the creation of beautiful things is not demoralising, so I have had no hesitation in recommending the study of Roman houses, villas, and palaces. In hearing the account of Pliny's villas you see to some extent the requirements of those days,—the choice of views, of sun and shade, of retirement and quiet; and you have the attempts of distinguished architects and antiquarians to re-construct the Laurentine Villa from Pliny's description. You must not even think that the Atrium of the Roman house is not adapted to English wants, for one of the great triumphs of Barry at the Reform Club and at Bridgewater House was the utilising of their Atriums by covering them with glass.

Whether it was from modesty or fashion that Pliny said nothing about his servants' housing I know not, but we can only deplore it. The series of cells (Cellatio) on the first-floor, that Trimalchio mentions, was probably the slave barracks. We find that Pliny had an apartment for his pages to sleep in, and that there were many of them in the room (Pliny 7, 27). As early as Plautus we find the women's slaves included, wardrobe women (Vestispicæ), a perfume-keeper (Unctor), a cofferer (Auricustos), fan-bearers (Flabelliferæ), sandal-bearers (Sandaligerulæ), singing girls (Cantrices), casket-keepers (Cistellatrices), messengers (Nuntii), news-carriers (Renuntii) (Plaut. Trinummus, act ii., sc. 1), and it is not likely that these were decreased as Rome became richer. There are inscriptions to the slaves of the Empress Livia,—the maid who combed her lap-dog is called "a Cura Catellæ"; another put in her earrings and was called "Auricula Ornatrix"; another put on her shoes, and was the "Serva a Sandalis"; there were the dress-folders and dress-perfumers, the hair-dressers, the hair-parter, the wig-keeper, the mistress of the rouge-pot, and of the powder-puff; but, as I told you before, there were names for upwards of 300 slaves. This affluence of slaves encouraged a passion for every possible convenience. We see how small an advantage was dearly purchased by Pliny in having a gallery built as large as a public one, merely for taking a walk in bad or hot weather. Nero's was a mile long.

The plan of a Roman house seemed so convenient to Palladio that he built the Convent of La Carità at Venice in imitation of one. These are his words:—"The following building is of the Convent of La Carità; where there are the regular Canons in Venice. I have sought to make this house resemble those of the ancients; and therefore I have made there the Corinthian Atrium: which is as long as the diagonal of the square of its width. The wings are two-sevenths of the length, the columns are of the composite order, 3½ ft. thick, and 35 ft. long. The open part in the middle is a third part of the breadth of the Atrium." (What he means by this I do not understand, unless he alludes to a rain-water tank in the open space.) "Above the columns there is an open terrace on a level with the third order of the cloister, where there are the cells of the friars. Adjoining the Atrium on one side is the Sacristy, girded with a Doric cornice, which carries the vault above; the columns that are seen there support that part of the wall of the cloister which in is the part above divides the chambers, or rather the cells, from the gallery. This Sacristy serves for the Tablinum (so they called the place where they put the images of their ancestors). Again, to suit myself, I have placed it on one flank of the Atrium. On the other flank is the place for the Chapter, which answers to the Sacristy. In the part by the church is an oval staircase open in the middle, which is convenient and beautiful. From the Atrium one enters into the cloister, which has three orders or columns, one above the other. The first is Doric; the columns project from the pilasters more than half" (he means from the piers); "the second is the Ionic, the columns are a fifth part less than those of the first; the third is Corinthian, and has the columns a fifth part less than those of the second. In this order in the place of pilasters there is a continuous wall, and in a straight line over the arches of the lower orders are windows" (*i.e.*, in a vertical line from the centres of the arches), "which give light to the entrance of the cells, the vaults of which are made of canes, so that they may not weight the walls. Opposite the Atrium and the cloisters beyond the walk the refectory is found, two squares long, and as high as the bottom of the third order of the cloister; it has a gallery on either hand" (how the refectory and the walk were lit the plans and sections do not show), "and under it is a cellar much after the manner that they make cisterns, in order that the water cannot get into it. On one side it has the kitchen, ovens, poultry-yard, wood-house, laundry, and a pretty garden, and on the other, other places. There are in this building, including rooms for strangers, and other places which serve for different purposes, forty-four rooms and forty-six cells."—(Pall. "I quattro libri dell' Architettura," Venice, 1570. Lib. 2, Cap. 6.)

The plans of the Palace of Augustus are worthy of your attention for many peculiarities. I mentioned before that the audience chambers, or Courts of Appeal, were of a peculiar shape, reminding one of Byzantine work (in Byzantine architecture these curious shapes were adopted to get abutments for domes and vaults); with the exception of the light they got from the outer doors, they seem only to get light from a grating at the top; how the rooms at the back were lit we do not at present know, as they abutted on a hill side, but probably by slanted shafts to the front of the Palace, as was done at Caracalla's baths. On the two flanks, the rooms next the Peristyle might have been lit from it, as we know nothing of how much of the wall was found, and the back parts might have been lit by skylights; but in the front of the ground-floor the circular rooms, if they really were without windows, could only have got a glimmer of light by reflexion from the passages; it is scarcely likely that they had gratings in the floors over them, and we are at a loss to know for what purpose they were used. If there were no upper story, the rooms on the first floor might have been lit by skylights. It has occurred to me that they might be bed-rooms, supposing that bedrooms were ever made circular, and the passages round them were Androns to prevent the inmates being disturbed by the noises of the streets. The street noises of a night seem to have been intolerable,—all the goods traffic being carried on between four p.m. and sunrise; and then, as now, in Italy, braziers and copper-smiths began work at midnight.

Seneca's description of the noises of the smith, the sawyer, and the musical instrument maker who tries his flutes and trumpets close to him is amusing. (Senec. Epis. 57, 13.)

I think there must have been a large opening, or several openings, in the wall next the Peristyle at the back of the Tablinum on the first floor, so that when it was wanted there might be a view from the Tablinum across the court.

One must bear in mind that the Temple of Apollo with its porticoes, the Temple of Vesta, the House of the Vestals, and the Grove, were within the Palace grounds, and that the Temple of Apollo was probably used by Augustus and his family as a private chapel.

When Lepidus, who was Pontifex Maximus, died, Augustus took the office himself, and as he was obliged to live close to the Temple, of which he was the guardian, and the Temple and the house of the Vestals was close to the Via Sacra, he moved the Temple and Virgins close to his palace.

The main hall of the Apollinean Library, if it was the original one, must have been magnificent, being 77 ft. by 56 ft., with its three large apses 37 ft. in diameter, but whether vaulted or not we do not know, and must have been well fitted for the meetings of the Senate, though one wonders how Augustus found them seats. The Senate-house or Curia, rebuilt by Diocletian, is now the Church of St. Adriano, and was drawn by Pirro Ligorio. The state-rooms of Domitian's Palace are on a grand scale, the throne-room 126 ft. by 100 ft., and the dining-room 107 ft. by 95 ft., without including the flat apses. The throne-room may possibly have been vaulted, but the dining-room was certainly not. If there are any sufficient remains of the bases of the columns the whole could be roughly reconstructed, as definite proportions were given to the columns and entablature, and possibly there may be scraps enough left to see what the carved decorations were like.

It is worth noticing how charming the dining-room must have been with one end open to the Peristyle, and with windows or sash-doors down to the ground on either side, so that the guests could see the plants in the conservatories, and both see and hear the plashing fountains.

I read you before Plutarch's remarks on this palace being more superb than the Temple of Jupiter Capitolinus, enriched as this was with the columns plundered by Sulla from the Temple of Jupiter Olympius at Athens.

However great a monster Domitian may have been, he evidently had good taste in architecture, or he would not have employed so able an architect to build his palace. The curved terrace or portico, 244 ft. across, he built in front of Augustus's Palace to overlook the circus maximus, must have been one of the finest sights in Rome.

Martial has many epigrams on Domitian's buildings, one long epigram on the glories of his palace (Lib. VIII., Epig, 36) I gave you in my last lecture; but as all his epigrams to the Emperor are particularly fulsome until his death I have not given them. When Domitian was assassinated he wrote in his Book of Shows (Lib. Spec. 33):—

> "How much thy third has wrong'd thee, Flavian race!
> 'Twere better ne'er to have bred the previous brace."

He has, however, another on the architect of the palace, Rabirius (Lib. VII., Epig. 56, p. 331), as follows:—

> "Rabirius model took from heaven to build
> Our wondrous Palace, sure; he is so skilled.
> For Phidian Jove a worthy fane to rear,
> Pisa* must beg him of our Thunderer."

According to Suetonius (Domitian 12), Domitian had exhausted the Exchequer by the expense of his buildings and public spectacles, but beyond this he says nothing of his Palace.

I have said in the lecture on palaces all I have to say about Diocletian's.

On reviewing the plans of these three epochs, the Augustan, the Flavian, and that of Diocletian, we see that there was much more thought and ingenuity bestowed by the architects on the plans in the first epoch than in the two latter.

From the houses at Pompeii there is much information to be picked up in the way of planning, particularly on angular and irregular-shaped pieces of ground, and in construction; much, too, may be learned in the way of ornamental-water work, for Pompeii is full of fountains, and you heard from young Pliny what pleasure the Romans took in the tasteful display of water. The whole town was a plastered one, with the exception of some of the public buildings, and from it we see how colour can raise this mean material to the highest position. If there is not much to be learned directly in the way of architecture, there is that which is more valuable, hints and suggestions of treatment, that we may require at any time in our practice. I may instance the Roman Doric columns covered with mosaic, and the way in which the mouldings of the bases were arranged to fit them for the application of mosaic.

I think I made it clear before that I was an ardent advocate for making every building a shrine of the three visual Fine Arts, and at Pompeii we see them combined; but I go further, and am equally desirous of seeing the household fittings and utensils made as beautiful as possible, so as to harmonise with the architecture, the painting, and the sculpture, as we see that the majority of them do at Pompeii. In one respect I think this beautifying of furniture, tools, and utensils is quite as important as the beautifying of buildings; for if the smaller things which are devoted to use are beautiful, the seeing them constantly must beget a taste for beauty in those that use them. Their beauty has, too, additional advantages, for it must cause the makers to be instructed in the art of beautifying the useful.

As far as architecture is concerned, it can hardly be expected that this great constructive art can become a necessity for all, nor can be so adequately fitted to its high position, if all the subsidiary constructive arts present nothing to the eye but utilitarian abortion; and when I speak of Architecture I do not mean mere building.

The capitals with figure episodes in them show the sculptor that they can be made more interesting and beautiful by the introduction of the highest form of beauty,—the human form,—and that their ornamentation is not necessarily confined to floral forms.

The painters, too, may see that however badly the subjects may have been painted, there was an evident desire to choose subjects that are fraught with lovely and dignified form, and connected by literary tradition with important and striking events. There seems an inclination in the present day to devote the genius that inspires the figure-painter and the extraordinary skill which has cost him so many long years to acquire, to immortalising events which not unfrequently are the most commonplace, and forms that are without dignity or beauty, when they are not absolutely ugly. For example: workmen drinking, outcasts gambling, or commonplace episodes in the dressing-rooms of theatres. Surely this entrancing art should preserve for us, and for posterity, the most perfect beauty, the noblest forms, the most delicate or most gorgeous colours, and those actions and expressions which charm the eye or ennoble the soul.

Personally, I am deeply interested in the bringing of constructive ironwork into the pale of architecture. It does have some place even now in modern building, and will, I am convinced, hold a conspicuous place hereafter in countries having a sunless and misty atmosphere, like our own, and in the narrow streets and frontages of manufacturing towns, where land is dear and light is scarce. I say this without diffidence, although there is so vast a majority of an opposite opinion.

Few architectural students care about solving the scientific problems of ironwork, and are sometimes indignant at being expected to study them, and the æsthetic part they tacitly but resolutely refuse to attempt. The former neglect somewhat lowers, and certainly impoverishes, the profession. The public will have what it wants, and this important constructive branch of the profession falls into the hands of the engineers; but as to the latter, it cuts to the very roots of the art, for if architects show that they cannot deal architecturally with new materials, the art at once sinks to a sort of dilettanti antiquarianism, on a par with heraldry or shooting with the long bow.

The light architectural edifices portrayed on the walls of Pompeii, and in some of the now buried chambers elsewhere, suggest ironwork to us; and though we perhaps cannot adopt any of the forms directly, they give hints for the sort of treatment that might be adopted. There is, however, this observation to be made: at Pompeii the capitals and bases have mostly been treated like the orders,—*i.e.*, proportioned to the diameter of the columns, while they should be proportioned to the height of the columns. The Italian architects, who dispensed with columns on the faces of their buildings, proportioned the crowning cornice to the whole height of the building.

Our architectural comrades in France, with that instinctive artistic perception which belongs to them, utilised these decorations as motives for the coloured ornamentation of cast-iron columns. The use of beautiful colour in buildings is fast becoming a necessity, and we may hope, ere long, to see enamel successfully applied to ironwork.

Before dismissing the subject of what we may learn from the antique, I may mention their ornamental plastering, which is probably the most beautiful that still remains; there is a freedom, an extreme delicacy, and a look of being done off-hand, that makes it most charming to my eyes; and had not the Romans been of the same opinion they would hardly have classed the ornamental plasterers with the architects, sculptors, and painters.

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* Pisa was another name for Olympia (sixteenth century MS.).

To the sculptors must be left the decision of whether the Roman plastering or the imitations of it by the Italian artists of the Renaissance bear the palm.

Professor Roger Smith has lent me the photographs of the charming specimens you see before you, some from the tombs on the Via Latina and some from Pompeii.

From the ornamental plastering that I saw, many years ago, in one of the chambers at Hadrian's Villa, for it seems now to be withdrawn from the public gaze, I am convinced that it was hand-modelled on the spot. We have in the present day in England much plaster-work that is very beautiful, but it is almost invariably cast work, and that involves much repetition.

I fear architects are too prone to fall in with the ordinary sweating system, even to chime in with a statement of its principles, when they are but put forward as a feint. Englishmen, as a rule, are patriotic; and if it is pointed out to rich men that it is a patriotic thing to encourage first-rate work, and the revival of artistic work, once even common here, and that neither can be got on those principles, I feel sure that some architects would succeed, and that we should be re-creating a school.

Artistic, however, as the Roman school of plastering was, it did not possess the transcendent merits of Greek art. Greek art aimed at simplicity as the true mark of excellence. This simplicity was not the native simplicity of a rude race, charming as that often is, but the product of the highest cultivation, and we admire it as we do the off-hand work of a great artist, who, with one sweep of his brush, will give a curve not only of perfect beauty, but of exact fitness for its place, and by the addition of a few blobs will make a piece of ornament infinitely more pleasing to an educated eye than the most elaborate work of a second-rate ornamentalist, just as the simplicity of Demosthenes surpasses the ornateness of Cicero. The Greeks used as little ornament as they could, but made what they did use as perfect as possible, so as to have "infinite riches in a little space," putting the ornament too, exactly where it was wanted, and leaving the spectator to wish for more; throwing down, as it were, the gage of challenge, as if the artist had said, "I have done my work, do it better if you can"; while as a rule the Roman work was overloaded with ornament, though it seems to me that it was less overloaded in their plastering than in their stonework. The Romans desired magnificence, the Greeks, art. I mention this lest you should think that the highest Roman standard cannot be surpassed.

Besides the important facts that the remains of Roman architecture are so numerous, and that Roman architecture was the mother of Byzantine, Romanesque, Saracenic, and Renaissance, the architecture of that great people is not without artistic merits of its own. It certainly attained dignity and magnificence, and occasionally the combination of size, proportion, and skilful lighting made some of its works sublime, as we see in the interior of the Pantheon, and in some of the ruins of the palaces and baths. Though it may appear rather paradoxical to say so, looking at the achievements of the present day; yet I cannot help thinking that the architects of Christendom have not as yet absolutely mastered architecture so as to be able to shape every new requirement and every new material that comes before them into a perfect architectural whole, different from the past, and yet equal or superior to it, for I cannot think that the want of a universal style is the fault of the architects. Captivating as originality is, there is too much evidence in England of a desire for quaintness, oddness, and variety at any cost; to the neglect of that laborious search after due harmonic proportion, without which the best architecture can only reach a secondary grade. The highest aim is to produce exquisiteness, majesty, or sublimity in buildings, and this can never be done until the art of proportion has been thoroughly mastered, and the architect makes architecture his expression of worship. This last phrase has been so much abused as to be equivalent not only to the religious devotion to an art, but to the abandonment of all the rules of morality as well; it is not, however, by brutalising ourselves by vice that we can attain the highest excellence, but by purifying ourselves by the practice of the virtues. We must first learn the elements of the supremely difficult and complex profession that we follow, more varied I fancy in its requirements than any other. We must not only study the great creations of the past, but endeavour to extort from them the secrets of their success; we must spare no pains in what we do, we must have an unselfish desire to see architecture soar to a perfection not hitherto attained, before we can even hope to equal the great masterpieces of antiquity, much less to surpass them. The very thought of surpassing all that has been done before raises a glow of generous emotion in the bosom of every architect, and no one can say when the time may come that people's eyes will be opened, and this master art again take the foremost place in the desires and admiration of the English-speaking race.

## SCULPTURE ON GREEK TEMPLES.—II.

### ROYAL ACADEMY LECTURES.

Mr. A. S. Murray, of the British Museum, delivered his second lecture* on this subject on the 20th ult.

The lecturer commenced by remarking that in a Greek temple the most striking feature was the pediment by which it was crowned. Having shown how the triangular shape of the temple pediment grew naturally out of the exigencies of roofing, he proceeded to speak of the sculptures in such of them as had survived. Of existing pediments we had three conspicuous examples: the pediments of Ægina, of Olympia, and of the Parthenon at Athens. But firstly, he would draw attention to certain small pediments which were found on the Acropolis at Athens during the recent excavations, and which, being older than the others, would be of interest as illustrating almost a first effort to obtain a composition fitted for a triangular space. These pediments had belonged to some shrine which had been destroyed when the Persians sacked Athens. The sculptures were in relief on the back of the pediment, the material being a sort of limestone, known as *poros*. A very free use had been made of bright colours, blue and red, which would be attractive in a rude early age. In one pediment the scene illustrated was that of Herakles slaying the Lernæan Hydra, a huge serpent with innumerable heads. This was on the right; on the left was the faithful companion of Herakles, Iolaos, standing ready with the chariot to bear Herakles off victorious. Fragmentary as the sculpture was, it showed that the sculptor had made at least one good observation in regard to the horses. The Lernæan marshes, where the incident took place, were to this day thick with runnels of clear, glittering water. No horse could stand there without lowering his head to drink, and that was precisely what the sculptor needed, to get the heads of his horses down into the contracting part of the pediment. The huge crab that filled in the angle had also a part in the legend, for while Herakles was still engaged with the Hydra the crab moved forward and seized his heel. The opposite angle of the pediment had been destroyed, but doubtless it was filled in by the lessening coils of the Hydra. As regarded composition, it was interesting to compare the chariot of Herakles, facing the angle, with the chariots of the later pediments of Olympia and the Parthenon, which faced the centre. In the west pediment of the Parthenon the horses, rearing towards the centre, represented the perfection of grouping, where chariots were concerned; while the small archaic pediment in question, with its chariot turned away from the centre, belonged to a stage of art when sculpture was hardly equal to the difficult task of representing rearing horses; indeed, it was a century later before art was sufficiently master of its powers to render a group of fiery horses. Similarly, in the east pediment of Olympia, though the horses were not rearing, their heads were turned towards the centre,—a departure from the archaic manner and an improvement in composition. The archaic manner had, however, the advantage that the sense was perfectly clear; the chariot was waiting to carry off Herakles when he had slain the Hydra. But as to the west pediment of the Parthenon, what troubles had we not had with the chariots facing the centre when the positions should have been reversed, according to our notions of the incident. We were told that in that incident the victory was won by Athene, and had her chariot been turned away from the centre, we could have understood the matter easily. But the great Greek sculptors apparently cared more for their art than for telling their story clearly enough for modern intelligence. The sculptor of the archaic pediment was more explicit: he wanted to tell his story. In the other archaic pediment, Herakles was represented, on the left, in the act of slaying a huge snake, possibly the Echidna, whose body seemed to be uncoiling itself out of the corner in which it had been lying. While, however, the serpent seemed to come out of a dark hole, Herakles equally appeared to advance from the broad light. By slaying the monster he illustrated one of those conflicts of the powers of light and darkness which played, or seemed to play, so large a part in Greek mythology. But in this pediment Herakles occupied a secondary position. His slaughter of the serpent paled beside the deed of his father Zeus, who slew the triple monster, Typhon, and buried him in the Serbonian marshes. On the right-hand side of the pediment we saw Zeus in the act of hurling his thunderbolt at the grotesque monster, whose tail coiled away into the angle. The sculpture of Typhon was very rude and very highly-coloured. Such work could not be much later than 700 B C. In this pediment, equally with the other, the sculptor had followed an order of composition in which the action moved from the centre towards the angles; and it would be interesting to know whether that was in general the archaic order as compared with the later compositions of Ægina, Olympia, and the Parthenon, where the movement was from the angles to the centre. At present we had not sufficient evidence on that point. In any case it was a splendid change from the archaic manner to the centralising of later times. The centre of the pediment then became the centre of action,—the place of highest dignity. From each side approached figures of ever-increasing importance in the scene. The great difficulty that remained was the filling-up of the angles with figures appropriate to the scene. In the pediments of the temple of Ægina the extreme angles were filled up by wounded men who had yet strength to raise themselves a little,—just enough to fill the increasing space of the pediment. Next to them came archers, who knelt on one knee to draw their bows; and so by a regularly increasing set of perfectly natural attitudes the centre was approached, and we looked for the incident which was to form the keystone, so to speak, of the story. In the centre was a wounded hero fallen to the ground; he had evidently been a leader in the fight, for while the opponents were eager to despoil him of his armour in the old Homeric manner, his friends made a desperate effort to save him. Meantime, in the very centre of the pediment, and directly behind the fallen hero, appeared the goddess Athene, visible to us, but probably invisible to the actual combatants, but in any case come to turn the scales of battle. So far as the indications of costume went, the battle was between Greeks and Trojans. Such was a brief outline of the composition of the Ægina pediments. These sculptures were worth careful study. They were, of course, archaic, and were conceived and executed in an archaic period. They did not exhibit the perfect freedom of form which we saw in the pediment sculptures of the Parthenon, and in subsequent sculpture; but they evinced the faithfulness with which the sculptor had observed the details of his forms, and the precision with which he had rendered them. There was abundance of reason to give him credit for recognising those many modifications of form which were necessary for a composition in which the various groups, though sculptured in the round, had yet in a measure to appear as in relief. He had to find a medium between the flatness of relief and the full roundness of a statue. In point of date the Æginetan sculptures stood about midway between the very archaic pediments before described, and the pediments of Olympia. Looking at the sculpture of the east pediment at Olympia, the first observation which suggested itself was that the sculpture, though manifestly later than that of Ægina, had gone back in a great measure to the older principle of relief.

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* For report of the first lecture see *Builder* for last week, p. 155.

But it was to be observed that the parts which were worked in relief had not, except in the case of the horses, been sculptured on the true principle of relief, which aimed at presenting to the front the greatest possible extent of the figure or figures. In the Olympian pediments the figures were, in a number of cases, sculptured on a background, and in that sense they were reliefs; but for the rest the projection was enough to make them look like actual statues in the round, and as such they were generally considered. Having discussed at some length the question of the subject and the arrangement of the figures in the east pediment at Olympia, the lecturer passed on to speak of the east pediment of the Parthenon, of the sculpture of which all that had survived was the group in each angle; the centre had disappeared, and with it the climax and key to the composition as a whole. The subject, we knew from a literary source, to have been the birth of Athene. After discussing the possible "interpretations" of this pediment, the lecturer, in conclusion, said that in archaic sculpture we had learned to admire the fine fastidious folds in which the drapery was systematically arranged, as if it had been put on a little wet and then pressed into shape. In the sculptures of the Parthenon, however, we had got rid of fashion and its fastidiousness. Beauty was found in the wider consideration of what was necessary,—no more and no less,—for a perfectly noble form. The dress, while it covered the forms, had no need to conceal them. It had, indeed, to be shown to be distinct from the forms beneath, and that was achieved by treating it as a perfectly distinct thing, movable and removable at pleasure. It thus aimed at a beauty of its own, and called upon the sculptor to reproduce the innumerable charms of light and shade which belonged to it under its aspect as an accessory with special features of its own. It was like the movement of a clear stream, which, though distinct from its rocky bed, yet owed its infinite charm to the configuration of that bed.

[We will give a report of Mr. Murray's third and concluding lecture of the series next week.]

## LECTURES ON THE MYTHOLOGY AND ART OF ATHENS.

In connexion with the Chelsea centre for the extension of University teaching, Miss Harrison is giving a course of ten lectures on Athens, at the South Kensington Museum lecture-theatre. In this course the lecturer is following up and combining the subjects of her lectures on Attic mythology in the autumn of 1886, and on Attic cults in the autumn of 1888, reports of both of which appeared at the time in the *Builder*. The present lectures go with much greater detail into questions of topography, and show the result up to date of the recent excavations at Athens. One of these discoveries is especially important. The river Eridanos has been discovered by Dr. Dörpfeld, north of the Akropolis. Its course followed roughly the line of the great sewer shown on maps to pass under the northern part of Athens; the river flowed out of the city at the Dipylon. This localisation of the Eridanos dims the importance of the Kephissos in Attic topography. In early times at least, *it*, and not the Kephissos, formed the northern boundary of the city, as the Ilissos did the southern. The theory is fully confirmed by a passage in Plato (Kritias, 112), who says that the city in old times was bounded by the Ilissos and the Eridanos, by the hills of Pnyx and Lykabettos. The Pelasgikon (*τὸ ὑπὸ τὴν Ἀκρόπολιν*. Thuc. II. 17), or old Pelasgic fortification which served as a defence to the Akropolis on its western side, is shown to have extended from the Klepsydra to the Asklepieion,—it was almost certainly used as a fortification down to the days of Herodes Atticus, when its course was slightly altered by the building of the Odeion. On the Akropolis the chief interest still attaches to the *old temple of Athena*, discovered in 1885, and to the remains of Pelasgic masonry near the Erechtheion. These pre-historic foundations are doubtless those of the well-built house of Erechtheus (Homer, Odyss., VII., 81). In connexion with Erechtheus the lecturer gave an interesting piece of mythological analysis. Erechtheus, one of the earliest kings of Athens, is originally but a surname of Poseidon. When the worship of Athene established itself firmly at Athens, to the gradual subordination of the Poseidon worship, it became necessary to connect the royal house intimately with the new goddess, but the ancient king, under his title of Erechtheus, was too strongly associated with Poseidon, therefore he must be, so to speak, reborn as Erichthonios. The Erichthonios of the Iliad (XX., 219), with his three thousand mares, who are loved of the north wind, is merely another form of the sea-god, but this aspect of him is less familiar to the Athenian mind, and since the end of the name Ἐριχθόνιος suggests a possible connexion with the earth, he is made into an earth-born King of Athens, entrusted at his birth to Athena herself. The story of his being enclosed in a chest and given in charge to the daughters of Kekrops, is one of those aitiological myths which are frequently met with in Greek mythology, and which often arose to explain ritual, the original meaning of which had been either obscured or forgotten. This particular story was to account for the mysterious ceremony of the Arrhephoria (Paus. I., 27), otherwise Hersephoria, when young maidens carried on their heads chests, the contents of which were to be unknown to them. Miss Harrison contends that what they carried were effigies of young animals (*ἕρσαι*). With these, the maidens were to propitiate already, at an early age, the goddesses of fertility,—but they must not understand the ceremony. Hence the injunction not to look into the chest, and threats to insure it. Hence also the story of what happened in the days of Kekrops to the maidens who opened the chest. The names of Herse and Pandrosos are themselves connected with young animals (*ἕρσηs δρόσος*). In passing from the ancient Poseidon and Erichthonios cults of the Akropolis to the Areopagos, the lecturer showed the story of the connexion of this hill with Ares to have arisen to account for the name of Areopagos, when its real meaning had been lost. The meaning may be arrived at from considering the importance of the worship of the Eumenides, who, together with the Chthonic deities (Demeter, Persephone, Triptolemos, Plouton) give the key-note to the mythology of this region. The shrine of the Eumenides was at the eastern angle of the Areopagos. From a study of (1) their early art form (note especially the series of Argos reliefs), and (2) their ritual (see Sophokl., Ord. Col., 470, scholiast on the lines), we infer that Pausanias is right when he says that Æschylos in his "Eumenides" first made them terrible. Originally they were austere and solemn, yet kindly nature-powers. It was as *Semnai*, or Venerable Ones, that they watched by the cleft on the east of the Areopagos. These Semnai themselves give a clue to the name of their hill. In Æschylos they call themselves *'Αραί, i.e.* curses (Eum. 416). May not the hill mean the hill of the curses or imprecations, of the mysterious powers of the under-world? Here Pausanias also noted a tomb of Œdipus (Paus. I., 28, 7), yet in Sophokles we find the Œdipus legend and the grave of the Furies, where he disappears, localised at Koloros. The explanation is to seek in the fact that to the early city, the Areopagos was the place *without* the gates. It was there that criminals were condemned, and outcast tyrants received. The place as such must not be within the city proper. But, as Athens spread, the hill of the *'Αραί* and the sacred shrine of the Semnai were no longer apart from the city—and so a new hill of cursing was made, with its worship of the Semnai and its grave of Œdipus, safe this time beyond the walls of Themistokles. The sacred enclosure of the Eleusinion, with its two temples, one of Demeter and Persephone, and the other of Triptolemos, lay almost certainly south of the Areopagos, not far from the Pnyx. This position is confirmed by the passage of Aristophanes (Thesmoph., 658), where the choros of Thesmophoriasuzai talks of searching the whole Pnyx (*τὴν πύκνα πᾶσαν*) for fear some man may be lurking there. During the performance of the mysteries of the Thesmophoria, which took place in the adjoining Eleusinion, the Pnyx was for three days given up to the women of Athens. For the cult and mythology of Eubouleus, another under-world deity, whom Miss Harrison shows to be originally another form of Hades and Plouton, a more general interest is now likely to be felt, owing to the beautiful head of this god recently discovered at Eleusis, and held by many to be from the hand of Praxiteles (Athens, Central Museum).

We will give a connected report of the remaining five lectures at the close of the course.

# Illustrations.

## SOME CHURCHES UPON THE LOWER RHINE.

Although the churches upon the Upper Rhine are well known to English archæologists and architects, yet those upon the Lower Rhine, especially between the German frontier and Cologne, are far less known than they deserve to be, and some views and descriptions of some of the most important ecclesiastical buildings in this district may be of interest to our readers—especially as the drawings are from sketches made on the spot, and the descriptions from notes taken down at the same time.

We commence our observations at Cleve, the capital of the old German Duchy of the same name. After passing through the vast plain which intervenes between Rotterdam and the German frontier, one suddenly comes upon a wooded range of hills, one of which is crowned by the old castle and Minster Church of Cleve. The pretty town winds gradually up the hill, by a steep, serpentine street. Although Cleve is a charming little place for the artist, there is not very much to detain the architect there. The castle, though an old building, has been too much modernised to be of any special value. It is true it contains two very singular-looking Romanesque doorways; so singular, in fact, as to raise a doubt about their genuineness; and some early inscribed tablets, several of which are Roman in date. The Hauptkirche, or Catholic parish church, close at hand, is a large, fourteenth-century building,* consisting of a very long and lofty nave and aisles, terminating in apses at the east end, with two towers crowned by tall slate spires at the west, and a graceful flèche in the centre. The building is constructed of red and white bricks, used somewhat haphazard, in places arranged in stripes, and then again in other portions of the structure used indiscriminately; the window traceries, doorways, &c., are all of stone. The interior of the church, though rather bald-looking, is finely vaulted; it contains two extremely interesting fourteenth-century monuments, a well-carved tryptich altar-piece at the end of the south aisle, and an elaborate "Aumbrey." The "Kloster Kirche" (Dominican Church) in the lower town is a remarkably plain fourteenth-century building of brick, but contains a set of well-carved choir-stalls. The "Evangelische Kirche" (Protestant parish church) is a most singular compromise between Gothic and Classic architecture, not unpicturesque, and dating from about the end of the seventeenth century. The neighbourhood of Cleve contains a number of very interesting churches. Eight miles off, on the opposite bank of the Rhine, is Emmerich, with two fine churches,—the older of which, called the "Minster," is a most eccentric Ecclesiastical building, and we should describe it as consisting of a great north transept with a low, narrow choir and a short nave (only two bays long) attached to it. There is a picturesque brick tower and, beneath the choir, a very early Romanesque crypt. For furniture a bronze Renaissance font and very elaborately carved fourteenth-century choir stalls are worthy of notice. The principal parish church, in the centre of the town, is a vast brick structure dating from the fifteenth century, with a very lofty western tower crowned by an octagonal lantern. Unfortunately the whole of the furniture, altars, &c., are poor late Renaissance work, and are not sufficiently interesting to make up for the want of architectural detail which is lacking in this huge, plain interior.

About five miles from Cleve and three from Calcar is a village called Wissel, which contains a very perfect twelfth-century church, consisting of a nave, aisles, transepts, and two towers, flanking the chancel, which retain their original gabelled cappings. The vaulting is quadripartite, each bay enclosing two pier-arches, but only a single Triforium opening and Clearstory window. There is a curious Romanesque font and part of a fifteenth-century organ-front. The whole building has been covered internally with modern decorative painting of a somewhat gaudy description.

Calcar, which is three miles further on, is an interesting little town, retaining its old walls and a plain but picturesque little fifteenth-century rath-haus; but the chief interest of the place attaches to the principal or Catholic parish church,—a most remarkable building. Externally, it is as plain as possible; it has high brick walls unadorned with either parapets, pinnacles, or string-courses,—nothing, in fact, but the window-tracery, and that very simple geometric work. The building consists of a nave and aisles of equal height, a long chancel with a chapel, the same height, on the south side, and one much lower on the north. There is a lofty brick tower, crowned with a slate spire, at the west end, and a deep porch to the south. The interior of the church is very fine, though rather plain; the piers are cylindrical, of brick plastered over, and scored in representation of alternate layers of wide and narrow courses of stone. The arrangement appears to be ancient. The capitals are foliated, and the vaulting is simple and exceedingly good. But what makes the building especially interesting is the quantity of magnificent furniture which it contains.

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* Commenced in 1334.

There are seven great triptych altars, all dating from the commencement of the sixteenth century. The high altar is a most wonderful composition. When opened, the triptych displays the whole history of the Passion of our Lord in one vast "alto-relievo" carved in oak, uncoloured. There are some 250 figures. The wings are painted by John of Calcar. The altar itself has an arcaded front.

Of the other six altars, that in the Lady-chapel, north of the choir, is the finest. The "Mater Dolorosa" in the centre niche, bearing the dead body of our Lord, is simply magnificent. The figures are about life-size: the finest work of the kind I know. The wings are painted. The two altars against the piers of the chancel arch are very rich, but a little confused in design. There are too many small figures introduced into them. The two other altars attached to the outer piers of the aisles are beautiful examples of very Early Renaissance carving. Each contains three large figures, standing in rich niches. Like the high altar, they are of oak, uncoloured. All these altars have painted wings or doors. That in the great chapel to the south of the choir is not so perfect as the others, but is still a beautiful work. Against the walls of this chapel are several old triptychs, pictures, monumental slabs, &c. In the chancel there is a very fine Sacraments-hauslein still in use; it is coëval with the church, the stalls are excellent, and their ends remarkably richly and beautifully carved. From a boss in the centre of the nave hangs a splendid chandelier, the upper portion of which is composed of wood, and adorned by two life-sized representations of the Madonna standing in a great open bower composed of branches of a "tree of Jesse." One statue faces east and one west. Below the statue is a great pedestal adorned with carvings and statuettes, and from its six angles start the brackets which support a number of candles. The whole is a remarkably magnificent work. The old Rood and its attendant figures are now over the north doorway. There is an excellent brass chandelier near the west end of the nave, and a good, though rather plain font in the south chapel. In a kind of chapel at the west end of the south aisle is a "Pietà" composed of figures carved in wood nearly life-size, all painted. It is rather a singular than a beautiful work, and dates from the commencement of the sixteenth century. Several inscribed tablets and other objects of interest are to be seen in this chapel.

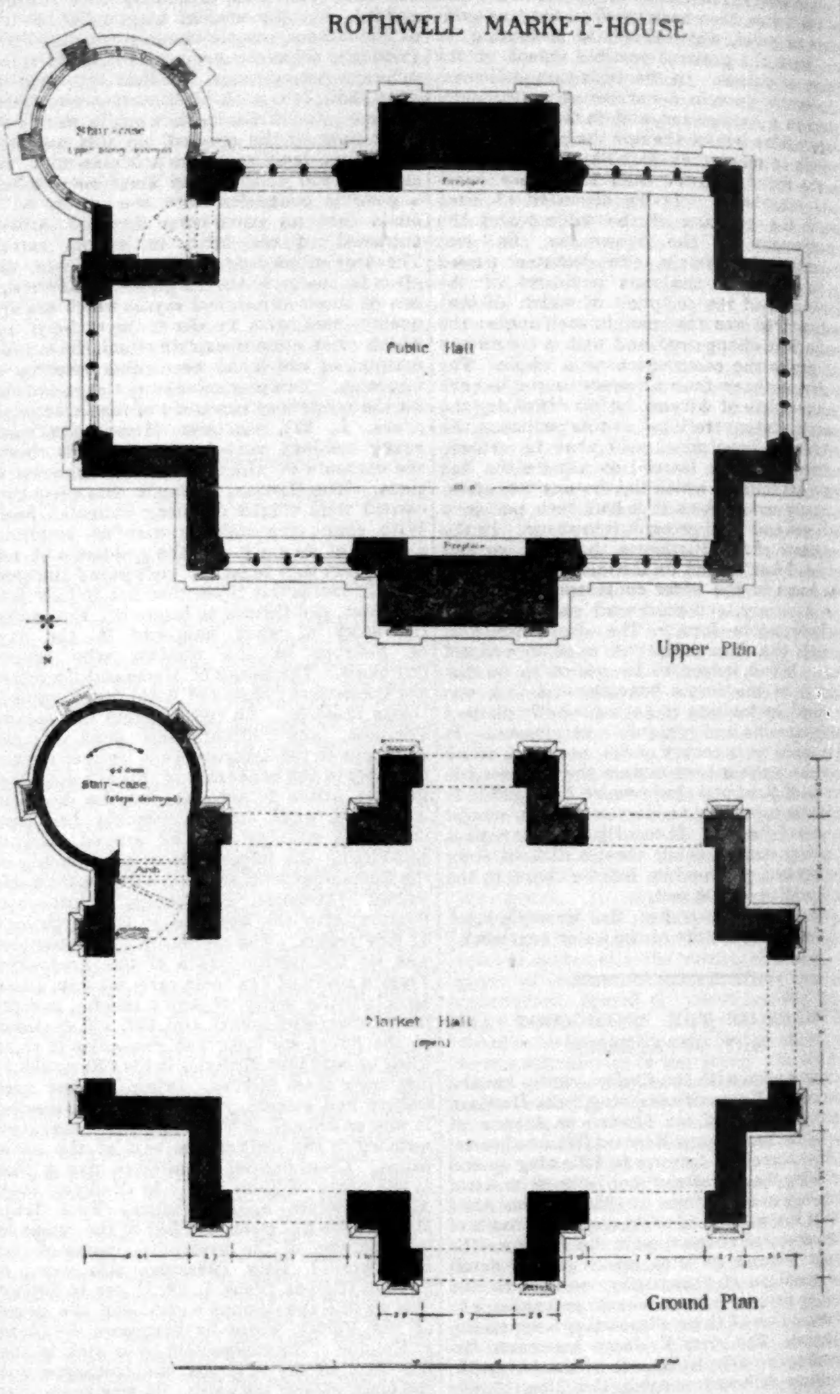
The effect of this great plain church with its singularly rich furniture is very striking indeed.

There is no old glass. Three modern windows, designed by Steinlie and executed by Capronier, above the high altar, though, no doubt, admired, are out of keeping, and too gaudy in effect. The grisaille in the side windows of the nave is unobjectionable.

The dimensions of the church are as follows:—Internally: Length, 180 ft.; width, 80 ft.; width of nave, centre to centre, 37 ft.; length of chancel, 60 ft.; height to vaulting of nave and aisles, about 70 ft.

The little town of Calcar has gained itself a great reputation for the school of painters who flourished there during the fifteenth and sixteenth centuries. Unfortunately, we are unacquainted with the names of most of these men, though the school had marked peculiarities which distinguish their works. John of Calcar was certainly one of the greatest German artists of the sixteenth century. The magnificent pictures upon the wings of the high altar of the church at Calcar would alone serve to establish his reputation. Other works of his are to be seen at Xanten, Cologne, Rees, Wesel, Dantzic. The ascertained dates of his works range from the year 1481 to 1516. The Protestant parish church of Calcar appears to be an old building, but it is very small, and so much modernised as to be of little interest.

H. W. B.



*From measured drawings by Mr. J. A. Gotch.*

## BURFORD CHURCH.

This building shows some traces of Norman work, but contains little of architectural interest beyond a fine and curious collection of tombs to the Cornwall family, especially a painted wooden altar tomb in the centre of the chancel shewn in the view, and a very curious painted oak triptych on the north side of the chancel, and the whole of this series of tombs has been carefully preserved. The greater part of the western tower was built in brick and cemented over in the last century; this has been rebuilt in Bromsgrove stone. The nave roof—an original trussed-rafter one—has been preserved and re-tiled. The chancel roof—a patchwork of recent years—has been replaced with a new one, and an oak-panelled panel ceiling with carved figures representing a complete choir of angels at the main ribs.

The church floor has been lowered to its original level and reseated in oak.

The reredos is a triptych, executed in mahogany, gilded and painted. The east window has been filled with new tracery and fine glass by Messrs. Powell & Sons.

Mr. Thomas Collins, builder, of Tewkesbury, carried out the work.

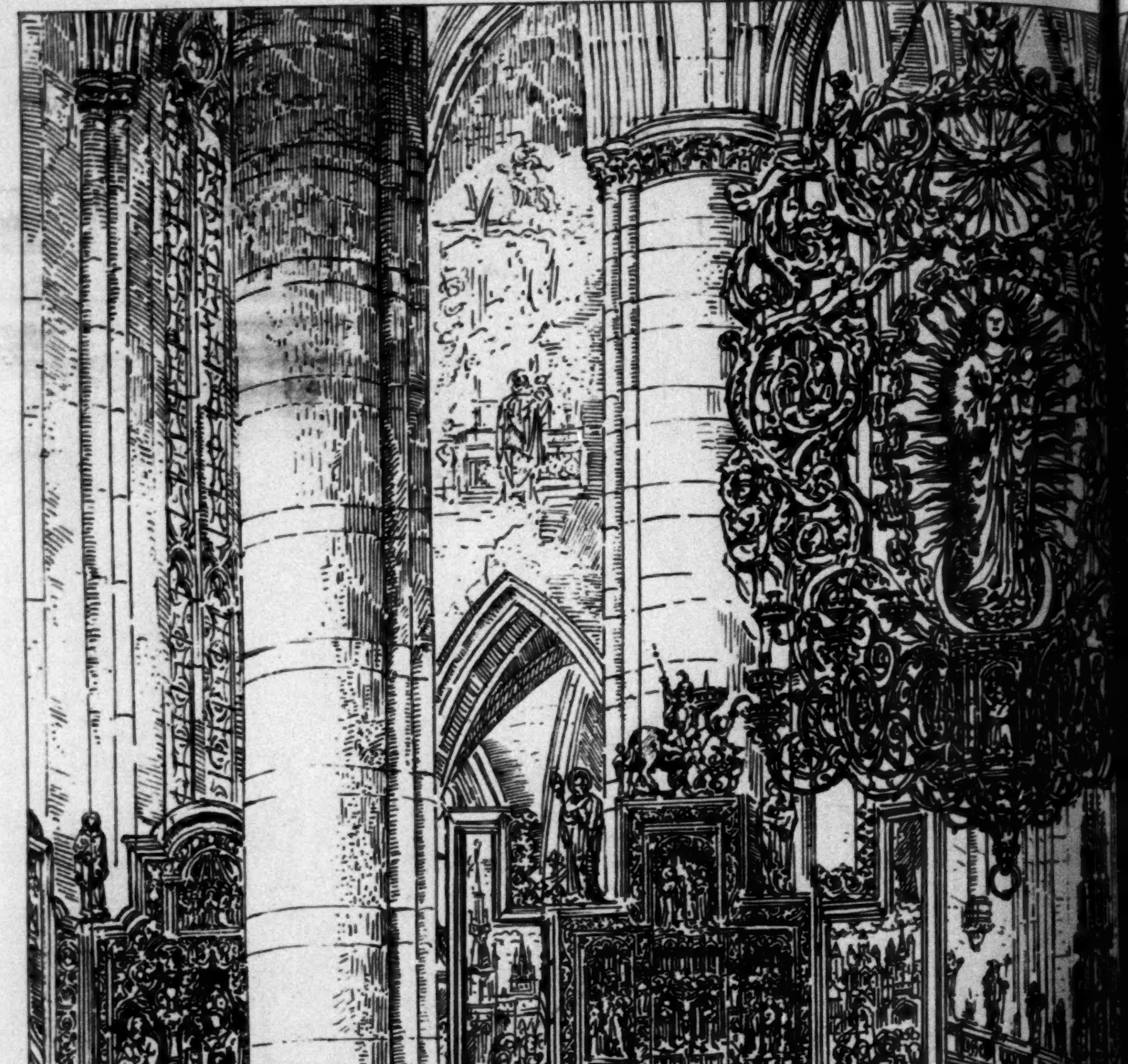
The whole expense has been borne by the Honourable Miss Rushout, of Burford House, as a memorial to her brother, the late Lord Northwich, to whom also a memorial lych-gate has been erected at the entrance to the churchyard by his friends and tenants.

## ROTHWELL MARKET HOUSE.

The illustrations of this interesting old building are reproduced from measured drawings by Mr. J. A. Gotch, which formed a portion of the illustrations to his paper on "The Renaissance in Northamptonshire," read before the Institute of Architects on February 3 of this year, and which appeared in the *Builder* of February 8th. The building was fully described in the course of the paper.

## CROMER TOWN HALL.

The foundation-stone of this building was laid by Mrs. B. Bond Cabbell, of Cromer Hall, on January 9, to whom a gold trowel was pre-



PARISH CHURCH

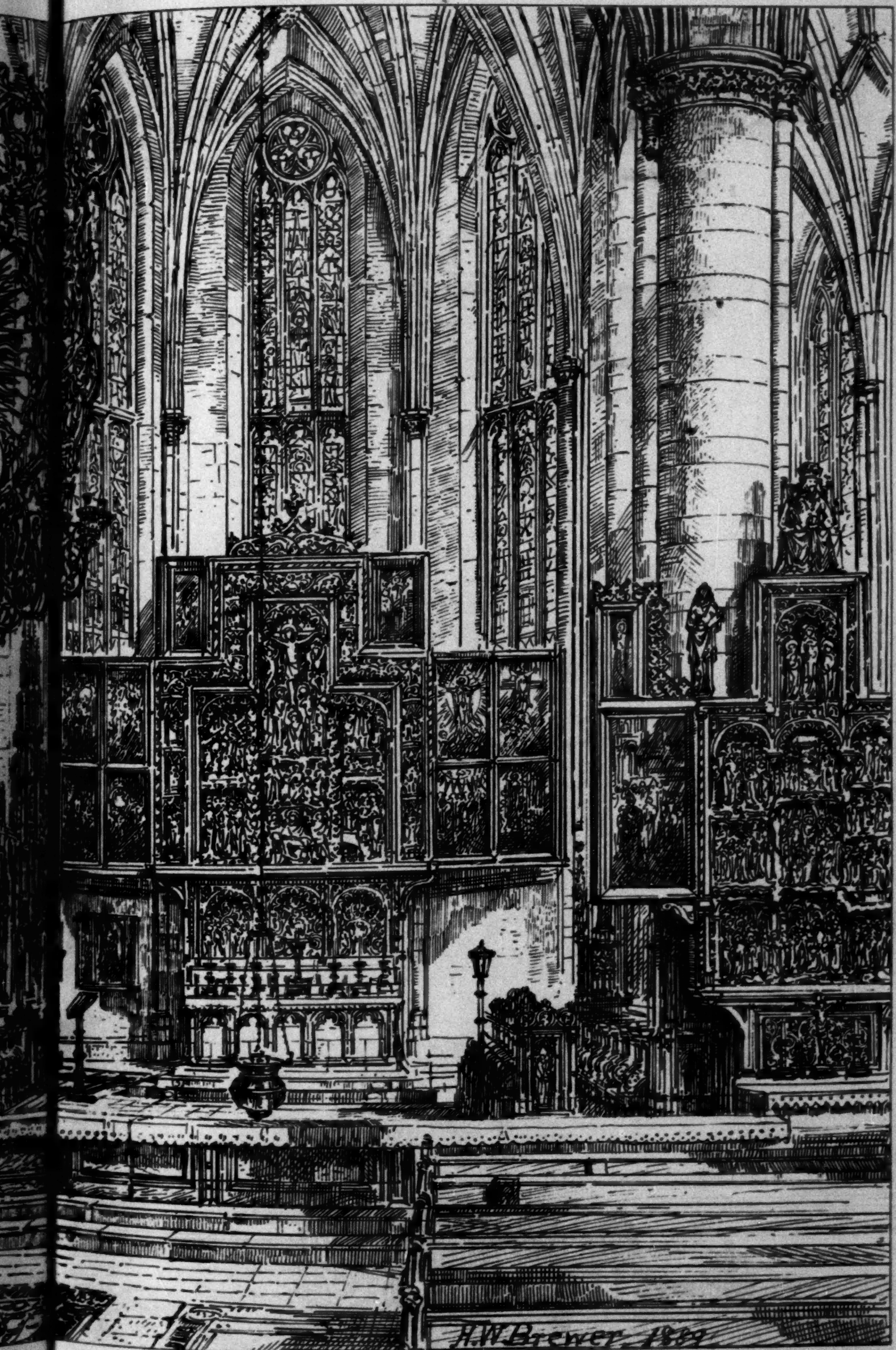
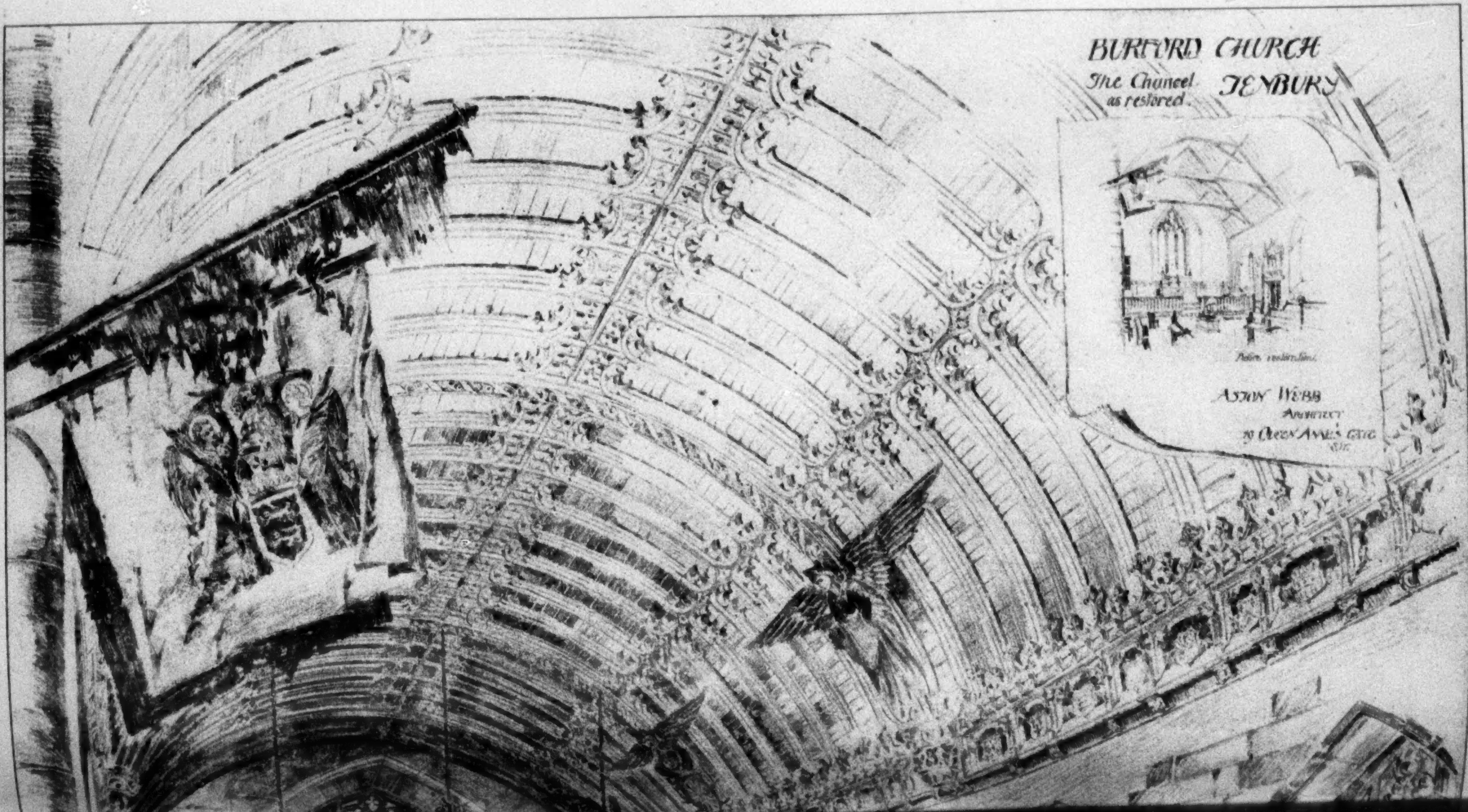
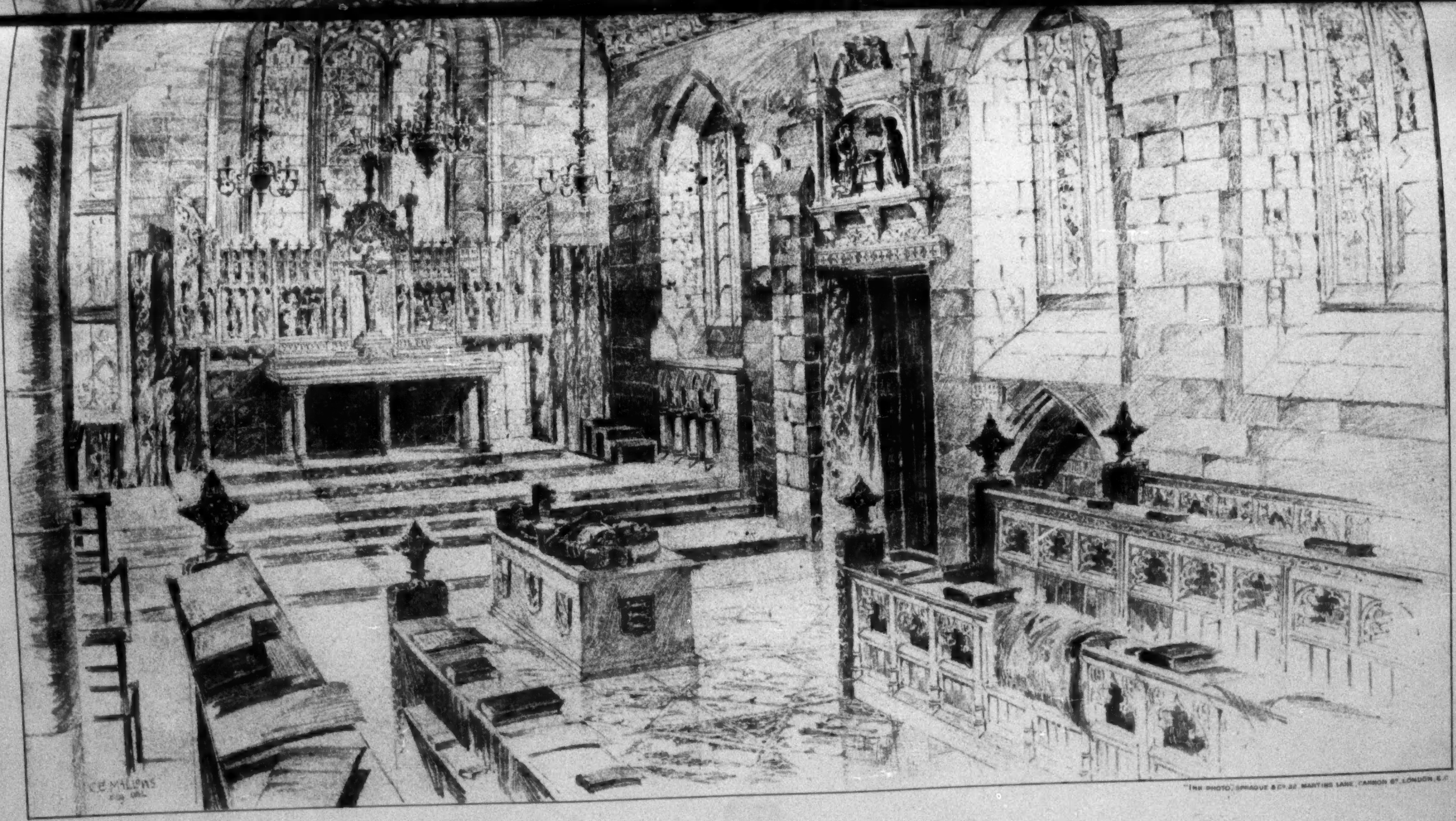

H.W. Brewer. 1889

PHOTO-LITHO. SPRAGUE & Cº 22, MARTINS LANE, CANNON ST, LONDON, E.C.

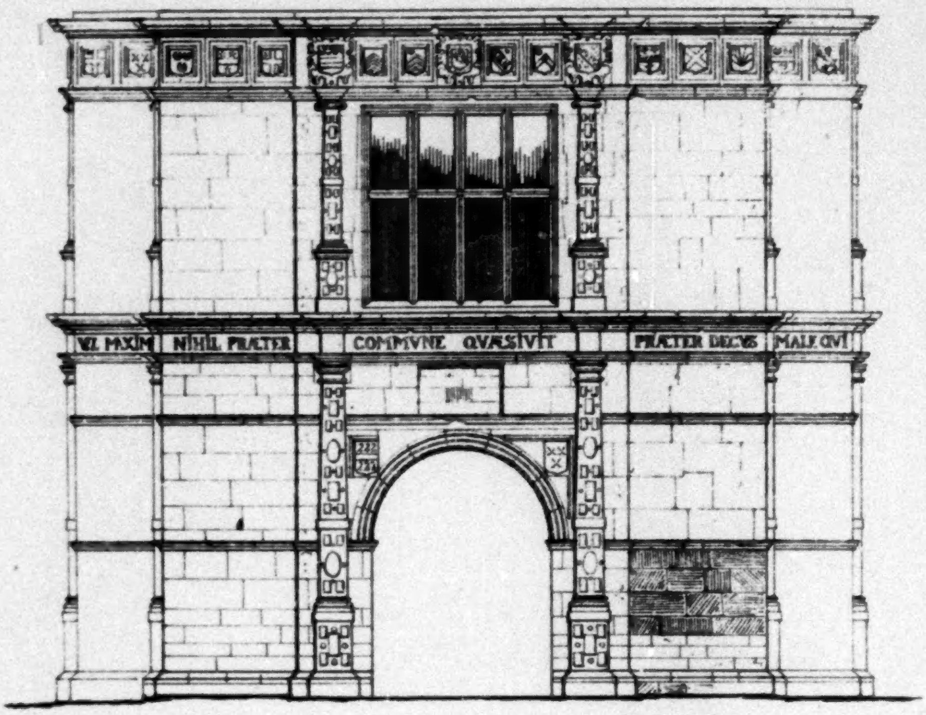
HURCH, ALCAR, GERMANY.


BURFORD CHURCH
TENBURY
The Chancel as restored.
Before restoration.
ASTON WEBB
ARCHITECT
20 QUEEN ANNE'S GATE
S.W.

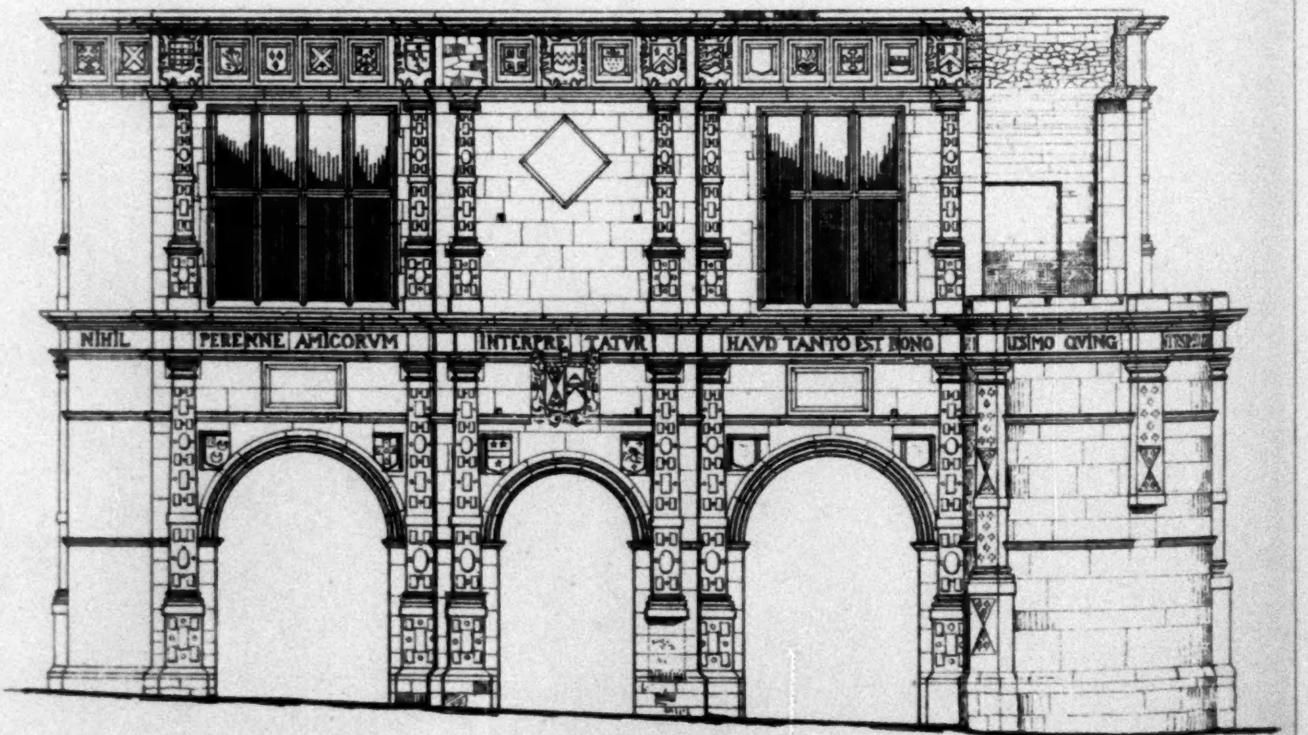


"INK PHOTO", SPRAGUE & Cº 22 MARTINS LANE, CANNON Sᵀ LONDON, E.C.

# ROTHWELL MARKET-HOUSE.


VZ MAXIM
NIHIL PRÆTER
COMMVNE QVÆSIVIT
PRÆTER DECVS
MALE QVI

West Elevation.


NIHIL
PERENNE AMICORVM
INTERPRE TATVR
HAVD TANTO EST HONO
USIMO QVING

South Elevation.

PHOTO-LITHO. SPRAGUE & Cº 22, MARTINS LANE, CANNON ST. LONDON, E.C.

MEASURED AND DRAWN BY Mr. J. A. GOTCH, F.R.I.B.A.

ON, E.C.

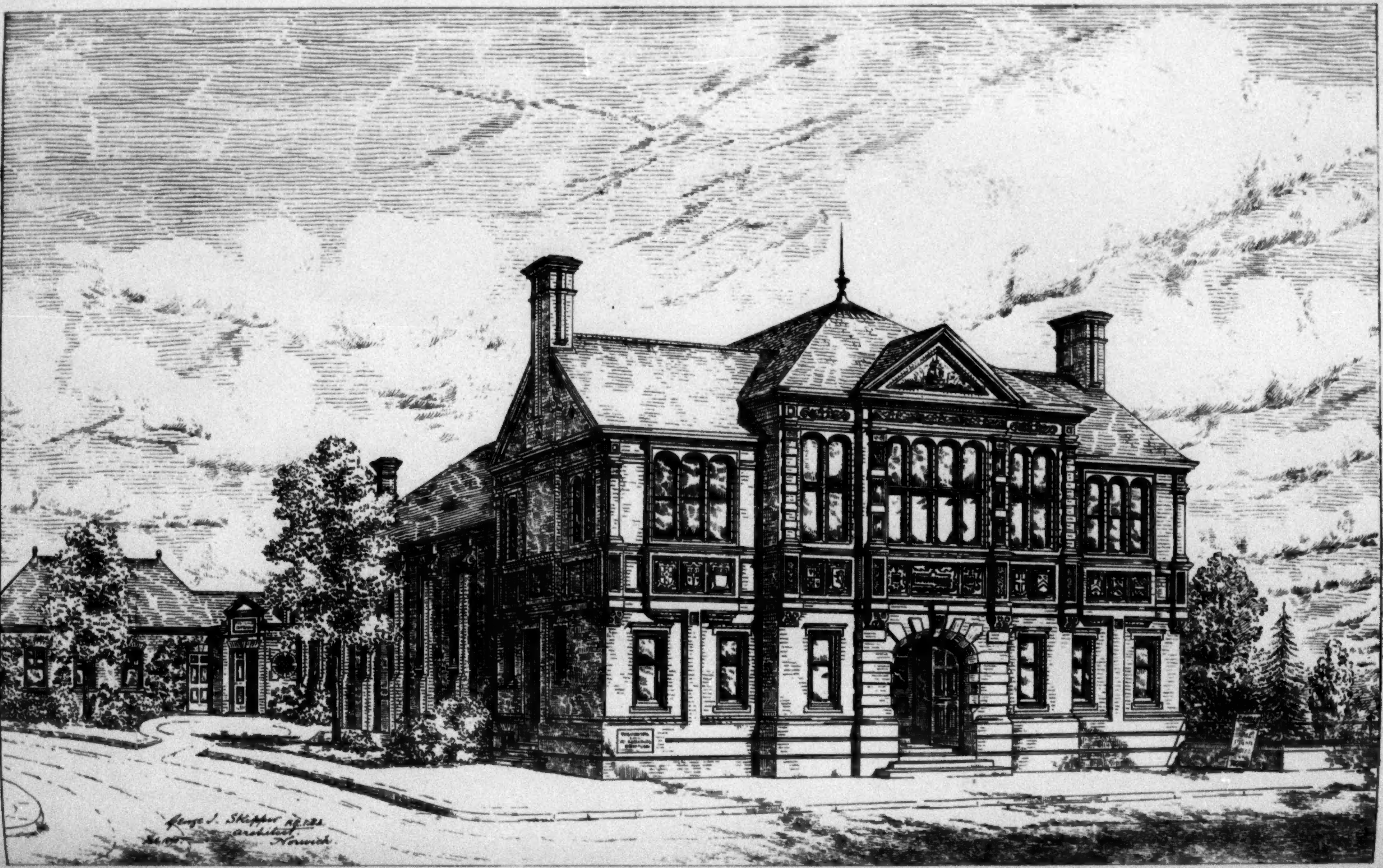
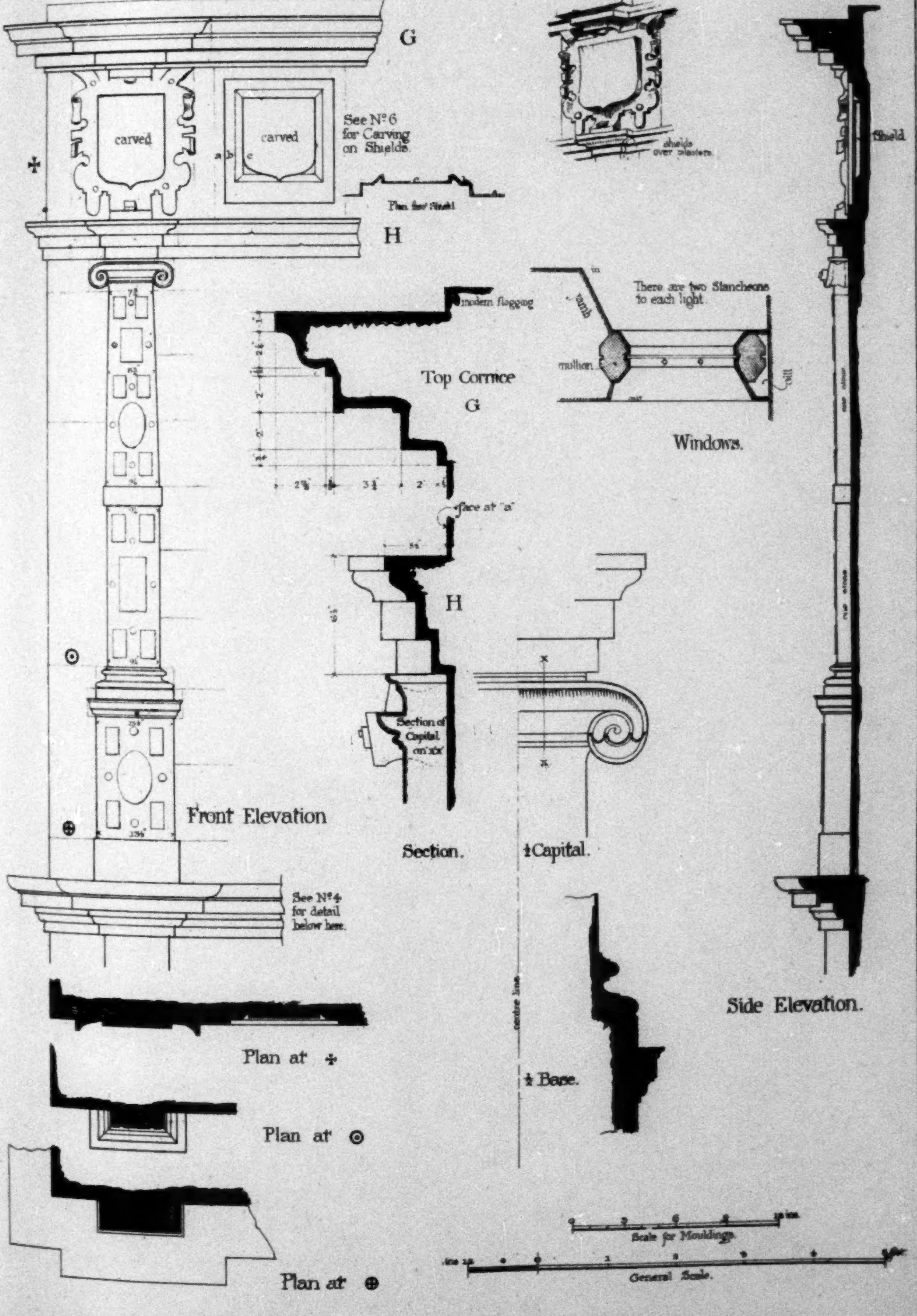

George J. Skipper F.R.I.B.A.
Architect
Norwich

PHOTO-LITHO. SPRAGUE & Cº 22, MARTIN'S LANE CANNON ST LONDON, E.C.

NEW TOWN HALL, CROMER.

# ROTHWELL MARKET-HOUSE.

## Details of Upper Storey.


G
carved
carved
See No 6 for Carving on Shields.
a b c
Plan for Shield
H
Front Elevation
See No 4 for detail below here.
Plan at ✣
Plan at ⊙
Plan at ⊕
modern flagging
Top Cornice
G
2¾
3¼
2
face at "a"
H
Section of Capital on 'xx'
Section.
x
x
½ Capital.
centre line
½ Base.
shields over pilasters
There are two Stancheons to each light.
jamb
mullion
sill
Windows.
Shield
Side Elevation.
0
2
6
8
12 ins.
Scale for Mouldings.
0
1
2
3
4
5 feet
General Scale.

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MEASURED AND DRAWN BY Mr. J. A. GOTCH, F.R.I.B.A.

# ROTHWELL MARKET-HOUSE.

## Details of Lower Storey.

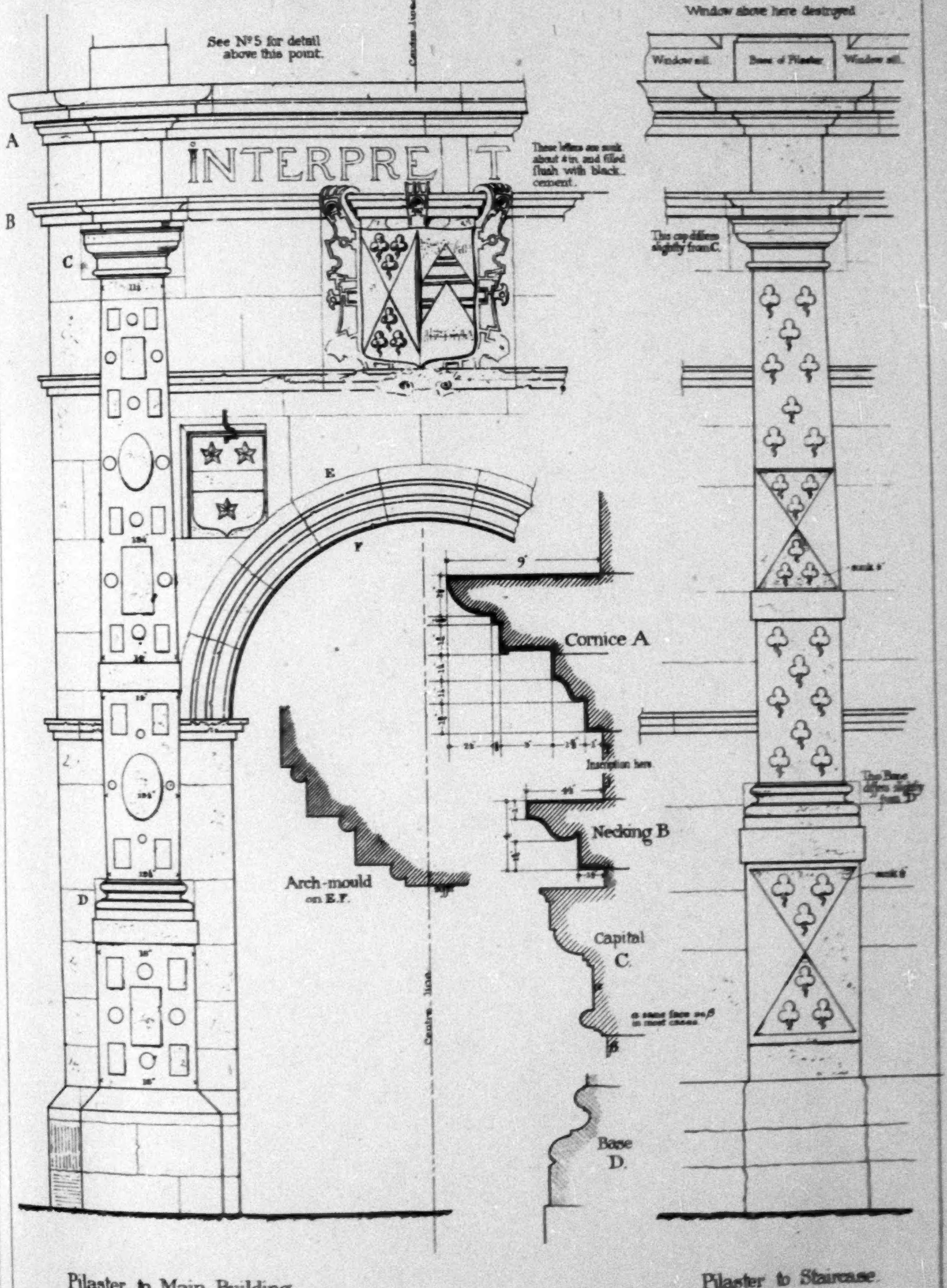
See Nº 5 for detail above this point.
Centre line
Window above here destroyed
Window sill.
Base of Pilaster
Window sill.
A
B
C
D
E
F
INTERPRE T
These letters are sunk about ¼ in. and filled flush with black cement.
The cap differs slightly from C.
sunk ¼"
The Base differs slightly from D
sunk ¼"
9"
Cornice A
Inscription here
Necking B
Arch-mould on E.F.
Capital C.
α same face as β in most cases
β
Base D.
Centre line
Pilaster to Main Building.
Pilaster to Staircase.
General Scale.
Scale for Mouldings.

PHOTO-LITHO. SPRAGUE & Cº 22 MARTINS LANE CANNON ST. LONDON E.C.

MEASURED AND DRAWN BY MR. J. A. GOTCH, F.R.I.B.A.

# ROTHWELL MARKET-HOUSE.

## Details of Lower Storey.

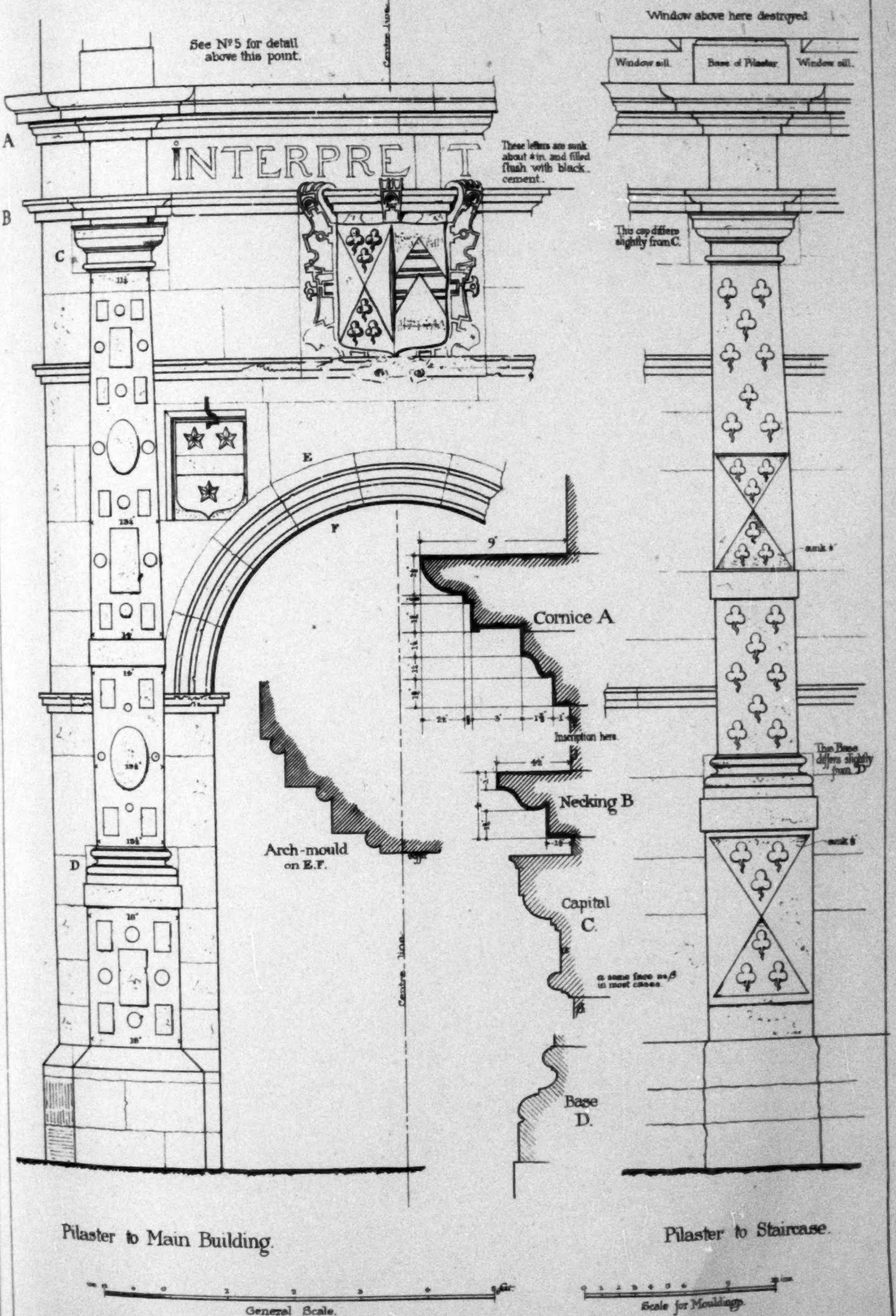
See Nº5 for detail above this point.
Centre line
Window above here destroyed
Window sill.
Base of Pilaster.
Window sill.
A
B
C
INTERPRE T
These letters are sunk about ¼ in. and filled flush with black cement.
This cap differs slightly from C.
E
F
9"
Cornice A
Inscription here.
Necking B
Arch-mould on E.F.
Capital C.
a same face as B in most cases.
Base D.
sunk ¼"
The Base differs slightly from D.
sunk ¼"
D
Centre line
Pilaster to Main Building.
Pilaster to Staircase.
General Scale.
Scale for Mouldings.

PHOTO-LITHO. SPRAGUE & Cº 22, MARTINS LANE, CANNON ST, LONDON, E.C.

MEASURED AND DRAWN BY MR. J. A. GOTCH, F.R.I B.A.

sented for the occasion by Mr. Samuel Hoare, M.P., on behalf of the townspeople. The architect is Mr. George J. Skipper, of Norwich, whose plans were selected in public competition in the autumn of last year. One of the special features in the external decoration of the building is the introduction of a series of panels containing the armourial bearings of persons connected with Cromer. The panels comprise the following arms:—Sir Nicholas de Wayland, first Lord of the Manor in the reign of Edward I.; Robert Bacon, who discovered Iceland in 1405; Sir Bartholomew Read, Lord Mayor of London in 1502, and who endowed the Goldsmiths' School at Cromer; arms of the Wyndham family and of the town of Cromer; Lord Suffield, present Lord of the Manor of Cromer Gunners; B. Bond Cabbell, Esq., Lord of the Manor of Cromer; and the family arms of the following:—Samuel Hoare, Esq., M.P., Sir T. Fowell Buxton, Bart., J. H. Gurney, Esq., and S. Gurney Barclay, Esq.

As to internal arrangements, the central doorway leads through a vestibule (with cloakrooms for ladies and gentlemen on either side) to a public hall capable of accommodating 900 persons. It is covered with an open timber roof, lighted by windows on one side and roof-lights. The walls are lined with match-boarding to a height of 5 ft. from the floor, and above this red brick work neatly pointed. The floor is laid in wood blocks. The heating is by hot water-pipes. Above the vestibule and cloakrooms, and approached by a staircase, having a separate entrance from the side road, are the reading and recreation-rooms. At the rear end of the block of buildings is the fire-engine station. Special crush-doors are provided, and all the doors to the hall are arranged to open outwards. Externally the walls of the building are faced with red bricks, and the roof is covered with Broseley tiles. The ornamental brickwork, of which there is a good deal, comes from Mr. George Gunton's Costessey Works. The carving has been entrusted to Mr. Minns, of Norwich. Mr. J. Newman is clerk of the works, the builders being Messrs. Chapman & Son, of Norwich. The heating apparatus will be supplied by Messrs. Sabberton Bros., Norwich. The carving under the pediment represents Robert Bacon's ship approaching Iceland.

## ARCHITECTURE IN OXFORDSHIRE.

### THE ARCHITECTURAL ASSOCIATION.

At the ordinary fortnightly meeting of this Association, held on Friday, the 28th ult., Mr. Leonard Stokes, President, in the chair, the following members were proposed for election, viz.:—Messrs. W. G. Legg, S. H. Gordon, G. H. Gill, H. B. Creswell, H. S. Morris, J. Robinson, and H. T. Bromley.

Mr. E. S. Gale (Hon. Secretary), announced the sessional visits for March, as follows:—March 8, visit to Mr. Sedding's new church, Sloane-square, Chelsea; March 22, visit to the new Central Offices for the Metropolitan Police on the Victoria Embankment (Mr. R. Norman Shaw, R.A., architect); March 29, visit to the new Hospital for Women in Marylebone-road (Mr. J. M. Brydon, architect). Mr. Gale also moved a vote of thanks to Mr. Colcutt for his kindness in connexion with the recent visit of the Association to the Imperial Institute, South Kensington.

The Chairman said he was sorry to say that Mr. William Pite was suffering from a bad cold, and was unable to read his paper on "Architecture in Oxfordshire." Mr. Hooper, however, had kindly undertaken that duty for him. We give the greater portion of the paper:—

When it was my happiness to start away for Oxfordshire, a tour which extended to four months, I thought I was going to do the county; but, though constantly at work, I was only able to touch four of the principal parts, so vast is the field and so much is there to see and learn, for the village church demands attention as much as her elder sister of the town or city.

* * * *

Time will not permit me to do more than indicate a few churches,—a catalogue would hardly be interesting without amplification. In the northern part of the county are three important churches,—one, it is true, in Northants, separated only by a canal; but the three within sight of each other, a few miles south of Banbury, each being celebrated for spires of singular beauty. A local rhyme discriminates between their merits, which, though only doggerel, introduces the names of the three churches, which we will review in order:—

> "Bloxham for length,
> Adderbury for strength,
> King's Sutton for beauty."

They are a study in themselves, in their influence on one another. They were visited by the Architectural Association excursion party in 1885.*

Blockesham, now corrupted to Bloxham, in William the Conqueror's time was part of the estate of Edwin, Earl of Mercia, who, provoked by the Normans, broke into insurrection: being betrayed by three of his captains, he and his brother Morkar, and Berdon, King of Wales, were slain fighting. The estate fell into the Conqueror's hands, and remained vested in the Crown till the reign of Henry III., when Almaric de Armand obtained it of that prince. This doubtless is the key to the architectural history of Bloxham. This noble church (see plan) consists of nave, aisles, chancel, and transept; while on the south side are two very fine fifteenth-century chapels, the outer one being the Milcombe chapel. Adjoining is a fine porch,† with priests' residence over, in two floors. In the church is a gigantic fresco of St. Christopher; while over the chancel arch, in a sunk recess, is a Last Judgment. A painted screen divides the chancel from nave. The former is most delightful in delicate Norman sculpture, quite equal to Romanesque as seen at Bamberg and other German places; here are pointed arches to the windows, with the Norman sculpture worked in, showing a studied economy in the Mediæval builders. The church is replete with interest. The north porch has a remarkable sculptured arch. In the north aisle are some magnificent traceried windows, with slight remains of stained glass. One of the windows in the north aisle,—a similar one being at Adderbury,—has the tracery converging, and finishing in a sculptured head. When I saw this it was fortunately unrestored. On the north elevation of the church is a remarkable animal and figure cornice, as seen in other northern parts of the county. The steeple rises from an octagon in a square tower, admirably arranged. Remarkable buttresses are at the angles, with niches and canopies; these, running up, finish in pinnacles, a traceried parapet running round the octagon. The west door is a remarkable work of the fourteenth century. The label is stepped, and there are sculptures of a Last Judgment.

Adderbury, the "Edburgberig" of Domesday, which, with Bloxham, was in Earl Edwin of Mercia's estate, and with it passed to the Crown, is a short distance off, and can be seen from Bloxham: its Norman castle has gone, but the magnificent church still remains, containing many features as seen at Bloxham. The chancel is a fine specimen of the work of William of Wykeham, Bishop of Winton, and the living naturally belongs to New College, Oxford; the glass of the east window contains his arms. The detail of the chancel demands long study, with its reredos and canopy-work to sedilia and east wall, which no doubt were once richly decorated. On the north side is a remarkable priests' residence, with second altar in a fine oriel window, and good turret stair leading to the upper chambers and the leads. The church abounds in detail, brasses, rood-loft, and screens, a magnificent cusped fourteenth-century roof,‡ and open-timbered. This church has had, as also Bloxham, a western gallery, and one can trace the same hand at work on both churches. The roof in the south transept was restored by an eminent architect, and I have a note asking "Why was it varnished?" Here are also more sculptured cornices, and we get an insight into local life. A husband, presumably, is agitating a fire with the bellows under a four-legged caldron, while his spouse is licking him into shape with a basting-spoon. Animals with gorgeous tails, foliated beasts, and griffins fighting, human beings playing on instruments, wind and otherwise; a man is stroking a donkey, while a dog is licking his own ear. The tread of the rood stair, it is interesting to note, is 4½ in. by 8¼ in. rise. The building presents a mass of questions relating to date and circumstance. The tower and spire are at the west end, the former opening into the nave. The spire and pinnacles do not sit very happily; they come within a traceried parapet, and angle buttresses taper to the ground.

Of St. Peter, King's Sutton, Northamptonshire, separated from the border by the Oxford canal, suffer but a word. The same hands have been here, and the local lines, attesting the beauty of the spire go without saying. Its wondrous symmetry and simplicity are enchanting; the tapering of the spire to meet that of the tower is very beautifully arranged. It is at the west end, and comes into the church, there being a fine fifteenth-century porch beyond.

A seeming parody on the three great churches are three village ones, lying a little south, but all within view, in a valley of beauty. They are easily reached from Chipping Norton, which latter church has a wonderful fifteenth-century window, with double tracery over the chancel arch, and a most singular porch. The village churches are Wigginton, South Newington, and Barford St. Michael, all of which are studies in themselves. We must away; many delightful experiences may be had by going to by-villages, and putting up at the "waysides." My task already is too great, and to do justice to many of these churches demands an evening to themselves.

The great church of St. Mary, at Witney, however, calls for some notice, as I went there specially, with orders to make drawings of the magnificent tower and spire at the crossing. I should weary you were I to attempt to dissect the parts; I wish, however, to enter a little into the history of its times, and the memories which cluster around it, which will go far to show how our national architecture is enfolded in our national history and daily life, and to offer an interesting suggestion which may call for consideration at your hands. There are remains of a Norman church which had existence previous to the costly reconstructions, adaptations, and additions of the thirteenth, fourteenth, and fifteenth centuries in aisle and transept. The presence of many altars suggests a large establishment; while, without, the one absorbing topic is, whence came such a stately tower and spire, with its intricacy of line, and bold simplicity, and oneness of conception? Let the rolls and records of our land speak. Ælfwine, or Alwinus, is reckoned as Winton's thirty-second bishop. Tradition states that there was a scandal about his relations with Queen Emm, mother of Edward the Confessor, who was born at Islip, near Oxford, and that she proved her innocence by the ordeal of red-hot ploughshares at Winchester, on which she walked unharmed. The good king made over the manor of Witney to the acquitted bishop, he likewise doing the same to his church chapter, or establishment at Winton. Dugdale gives a list of others handed over at the same time. Hence arose the episcopal palace on the east side of the church. Stigand succeeded Ælfwine, and Stigand was in turn succeeded by Walkelin (Stigand being made Archbishop of Canterbury A.D. 1052, deprived by William the Conqueror in 1070, and dying the same year in prison). Walkelin was a great builder, and much of the nave of Winchester Cathedral is attributed to him. It is not improbable that he built the palace at Witney. For thirty years he is said to have divided his time between Winton and Witney; if that be the case, it is well within reason to expect that he exercised his skill upon the adjoining church. We may possibly credit him with the beautiful north porch, which is of his time; and, though not exactly relevant, it is of the highest interest to recall the fact that in his episcopacy the great Domesday Survey was made or completed. Therefore, we are led to conclude that the great Norman church owed much of its structure to Walkelin, and its inspiration to noble Winton of East Anglia; and here, housed midst shady trees, this not less learned and exalted ecclesiastic, though not so over-worked and over-worried as his more modern brethren of the bench, has added his tribute to what is to us, gentlemen, "a mine of memories." William Gyffard, the next Bishop of Winton, was Lord High Chancellor to King Henry I., and in that, like Cardinal Wolsey, he was for his separated profession too much the servitor in the temporalities of his sovereign. He was succeeded by the long episcopate of Henry of Blois, who came to his throne in 1128, and spent a great deal of his time at Witney, and dying in 1174. No doubt the reconstructions were set on foot under this great prelate. But we must hurry on to the thirteenth century, when, after two bishops—to wit, Richard and Godfrey, of whom we know next to nothing—we come to Peter de Oriol (Winton's thirty-ninth bishop), who spent much leisure at the palace and park of Witney. At Cogges there still exists Park Farm, and an open ditch called Emm's Dyke, after the queen-mother of Edward the Confessor before referred to. In 1221 Bishop Peter de Oriol obtained royal warrant from Henry III. to purchase and receive of Robert de Arsic's barn at Cogges, "building timber from his woods." These woods are still at Cogges, a mile or two from Witney. The bishop's clerk, Dionysius, was Rector of Witney—a man of importance in his time. The Fifth Crusade took place under John Brienne in 1217, and the returning warriors, passing through Calvados, stand face to face with the surpassing beauty of the western façade of Bayeux Cathedral. One of the gentlemen present views the fairness of the spire and pinnacles aright for his Witney friends. Whether by a manipulated memorandum or not, we incline to the suggestion that this vision of the beautiful was safely conveyed to England and bloomed again at Witney,—a French poem translated with consummate art into living English, in Witney's buttressed tower and pinnacled spire. The slopes of the tower are remarkable; also the peculiar angles and differences of the buttressing; and it should be further noted the tower is not central with the transepts. Witney has influenced Bampton and Broadwell in towers and spires, but beyond that it seems to stand alone.

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* See the *Builder* for Aug. 15 and 22, 1885, pp. 237, 250; also the numbers for Sept. 12 and Sept. 19 of the same year for various sketches of Oxfordshire churches visited on that occasion.

† See sketch in the *Builder* for Sept. 12, 1885.

‡ See sketch in the *Builder* for September 19, 1885.

Cogges lies just outside Witney, and has a small but most interesting church, with a fourteenth-century octagonal tower placed obliquely at the west end,—a singular arrangement. The place has a remarkable history in the roll of time, and has a connexion with Witney; it was the church of the Barony of Arsic, of which Manser de Arsic was lord. The family was descended from the Earls of Oxford, and as ancient as the reign of Henry I. The baron gave the church to the Black Monks of Fiscamp, in Normandy, who sent over part of their convent and founded a cell, which was dissolved by Henry V., with the other alien priories. Some of the ancient stone barns still exist adjoining the church.

Eight miles from Witney, and four from a railway-station, is the enchanting town of Burford, little known, possibly through its isolated position. The importance of the place calls for notice at our hands. Delightfully situated on the Windrush, which comes from the Cotteswold, one crosses the ancient winding stone bridge, and stands at the head of the broad High-street,—ancient houses to the right and left making unnumbered mental calls to be inspected. That we cannot do now; our visit is mainly to have a hurried look at the great church, which Mr. Street, with his intimate knowledge of the county, has said that of all the churches in the diocese of Oxford, Burford is not only the grandest in scale, but that also in its architectural detail it is singularly rich and beautiful. A word on its early history gives us the origin of the dedication of the Church to St. John the Baptist. By the Saxons, Burford was known as Beorford, of which the present name is a corruption. In 685 an ecclesiastical synod was held here by the Kings Ethelred and Berthwald, at which Aldhelm, Bishop of Sherborne, was ordered to write against an error respecting Easter. In 752 a battle was fought between Ethelbald, King of Mercia, and Cuthred, King of the West Saxons, who had revolted. Ethelbald was defeated, and the Royal Standard, bearing the device of a golden dragon, was captured. To the west of the town is a place called "Battle Edge"—this in all probability is the site. A custom for long was kept up of parading the streets with all "jollity" with a "Golden Dragon" on Midsummer Eve (St. John-the-Baptist's Day). After the Conquest, however, the town was bestowed on Robert, Earl of Gloucester, natural son of Henry I. In Oxfordshire, with such variety, where one sees great churches, as Bloxham, Witney, Bampton, and Dorchester, when we come to look at Burford, for concentrated interest it excels them all. We need only refer to its ground-plan, its many aisles, its great lengths, and manifest additions, to see and admit that there is historical association circling the building, without which we cannot attempt to comment upon its composition. This, again, goes to prove how in the times gone by building arose simply out of the necessities of the case; wants were felt and met, and surely such churches would not be provided unless there was a far larger congregational demand than that which, at least at the present time, exists either at Burford or elsewhere. It is unnecessary to enumerate the dates at a church like Burford, for it affords to the observant student a complete dictionary of Mediæval architecture in matter and detail. The church lies very low, and the mill-stream which bounds the churchyard is uncomfortably near. The interest possibly centres in the tower, which has most excellent Romanesque work, surmounted by a late fifteenth-century tower and spire. No doubt the very irregular shape of the church is the result of the linking together of two distinct buildings. Mr. Street thought that what is now called the Sylvester aisle was a chapel standing quite distinct from the church, which was founded in the thirteenth century, and was not joined to the church by the opening of the arches until the fifteenth century, when it was also lengthened eastwards. All this has resulted in detriment to the magnificent south porch, which was once partly detached, and is now completely imbedded between this aisle and the western of the two south transepts. The altar at the east being a great distance off, and the narrowness of the tower arches being inconvenient for comfortable service, one has little doubt but that they decided to develop the church at the west end. That the porch was distinct from the Sylvester aisle is clear from the fact of there being a buttress and the plinth returning round. A chapel was accordingly erected of stone, with a wooden tester under the easternmost arch of the nave arcade. This, architecturally, is a most ingenious arrangement, which Mr. Street fully restored, and of which he remarked that he knew of no other similar example. Observation on the spot shows that most people can see better at this position than at any other; though the position is probably open to serious and divided ecclesiastical opinion. The church contains an excellent fourteenth-century sculptured font, and it is curious to observe that the sedilia to the font are only 9 in. high. Pulpit-roofs, ironwork, and the many beautiful windows call for the undivided attention of the student. In the south transept is a Purbeck tomb, the inscription being on the exterior soffit of the arch with a canopied niche over it; it thus runs:—"Orate pro animabus patris et matris Johannis Leggare de Borford per quem ista fenestra decoratur." No less interesting is it to read an early specimen of English prior to the Reformation, when the people were aching to be done with the bands of "Latinity." Here is a specimen of English as she was spoken in 1437:—

> "Mary moder mayde cler, haue mercy on me. Jon Spicer.
> And on me Alys his wyff, lady for thi joies fyve.

I trust my task has not been in vain in having endeavoured to show you that the characteristics of a few churches, the nave arcades of Oxford, and some other subjects, as the roofs and porches, &c., provide matter for others to take up with very great profit, and I trust that as the summer comes upon us we may have the opportunity of again seeking and studying noble work in ancient stones.

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Mr. H. D. Appleton, in proposing a vote of thanks to Mr. Pite for his paper, and to Mr. Hooper for having read it, said that the paper was one of great interest to them, notwithstanding that the district covered by it had been visited, as had been stated, during one of the annual excursions of the Association.

Mr. L. A. Shuffrey seconded the motion, which was supported by Mr. F. R. Farrow (Hon. Sec.), and Mr. C. H. Brodie, who said he was somewhat surprised to find Mr. Pite suggesting, in the first portion of his paper (which we have been obliged to abbreviate), that mouldings should be drawn one-eighth, one-quarter, or one-half full size. He thought it a good thing for Mr. Pite that his brother was not present.

The Chairman, in putting the vote of thanks to the meeting, begged to include in it the name of Mr. Bolton for his kindness in having made a large number of the many plans of churches which were exhibited on the screens.

Mr. Hooper having said a few words in reply, the meeting terminated.

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**The Sanitary Institute.**—The Council have accepted an invitation from the Town Council of Brighton to hold the Autumn Congress and Health Exhibition in that town in September next.

## FREE LECTURES TO ARTISANS AT CARPENTERS' HALL:

### PROFESSOR W. H. CORFIELD ON "MODERN SANITATION."

The third of the present series of free lectures to artisans and others on matters connected with building, under the auspices of the Worshipful Company of Carpenters, was delivered on Wednesday, the 19th ult., by Professor W. H. Corfield, M.A., M.D., his subject being "Modern Sanitation." Mr. Joseph Preston presided, and there was a large attendance.

Professor Corfield said the subject of "Modern Sanitation" was a very wide one indeed, and, if taken in its widest possible sense, it could not be embraced within the limits of a single lecture. He would, therefore, limit his remarks to the question of the removal of refuse matters from our houses; and, in the first place, would consider the improvements that had been made in recent times in the materials used in the sanitation of houses; in the second place, the improvements made in the arrangement, trapping, and ventilation of drains, and other waste-pipes; and, in the third place, the improvements made in appliances and apparatus. Until comparatively recent times all drains were made of stone, brick, or pervious agricultural pipes. The first and greatest improvement that was made in the construction of drain-pipes for houses was the one which consisted of making them of water-tight material. It was recognised then for the first time that pipes which had to carry away foul water should be, in themselves, impervious to water, and in the first place they had pipes made of a material known as glazed stoneware. But though it was very well to have a pipe which was impervious to water, these pipes could not be made of indefinite length. Their ordinary length was 2 ft.; hence the question of jointing them, so that they might be impervious to water throughout, was of great importance. The first method adopted was that of making a socket at the one end of the pipe and putting the other end into it, and putting in some jointing material. Pipes could be put together in that way without any jointing material at all, and so, as a matter of fact, they very frequently were. He would not say are, because he hoped they were not at the present moment. They were, as it was technically called, "laid dry," without any material in the joints at all, so that they might as well have had the ordinary agricultural pipe-drains. Sometimes they were jointed with clay, and no doubt a fairly good joint from one point of view might be made in that way; but clay was a material which easily softened when wet, and so the usual method was to joint them with cement. Several difficulties, however, arose in connexion with that method, the first being that the cement projected into the interior of the pipes, set there, formed bosses in the drain against which foul materials collected, causing obstructions, and gradually blocking-up the drain. Another difficulty was that the pipes might be laid and cemented round the upper part of the joint only. Although, when inspected, the drain would look all right, yet there might be no cement in the lower part of the joint at all. That was a very serious difficulty, but it was overcome, like several others of the kind, by more accurate methods of jointing. Before these methods were devised, however, the method was sometimes resorted to of putting what was called a "cradle" underneath the joint and filling it with liquid cement, so that then the under part of the joint must be filled with cement as well as the upper part. All these difficulties of jointing pipes with cement,—which method, however, was even now one of the very best if properly and honestly carried out,—had led to other devices. One of these was that adopted by Mr. Stanford, who first conceived the idea of making a ring round the end of each of the pipes, one in the socket and one on the spigot. These rings, made of a preparation of asphalte, were carefully made by being cast in steel moulds, and when the end of one pipe was put into the socket of the other, it made a perfectly water-tight joint. That joint of Stanford's had been very largely and successfully used, and it had been improved upon recently by Messrs. Doulton, who had made the surface of the ring curved, to fit into the ring in the socket end of the pipe, so that if the pipes shifted a little the contact still remained complete. This method avoided all the disadvantages of cement. Several other joints had been devised for stoneware pipes, but he did not think he need do more than merely mention them. One was Messrs. Hassall's joint, and another the "Archer" joint. These, however, were somewhat more complicated. One of the great advantages of glazed stoneware pipes was that they were made of a material which was perfectly unalterable. Another kind of pipe very largely used for drain purposes was the cast-iron pipe. These had several great advantages. Of course they were impervious to water, and they were coated with a material which prevented the iron rusting. They could be jointed with perfectly water-tight joints by means of molten lead, and they were made in lengths of 6 ft., thereby lessening the number of joints. These great advantages were put forward by those who advocated the use of cast-iron drain-pipes, but against these had to be set the disadvantage that iron was a material which was destructible by water, moist air, acids, &c. So long as the coating was perfect it was all right; but if the pipe was chipped or knocked, or the coating became removed by abrasion or other cause, all these formed weak places, which were likely to lead to the destruction of the pipe. However, after all, that was a matter of experience. They had come to understand in recent times that it was essential that drains laid under houses should have a firm bedding, and now this was recognised as practically essential in all cases, although it was more or less of an innovation to cover them with concrete. Whatever material was used for the construction of drain-pipes, they must insist that they should be water-tight,

The lecturer next proceeded to consider the materials used for, and the improvements in, the construction of soil and other waste-pipes. Two materials had been used for a very long time,—namely, iron and lead, so that one could not say that there was much improvement in materials. Lead, generally speaking, was a better material for soil-pipes than iron; and that it was not used to the exclusion of iron was due to the fact that it was much more expensive. Not so long ago, water-closets were almost universally connected with the rain-water pipes of houses, but such a monstrosity was not allowed in "modern sanitation." Leaden soil-pipes were better than iron ones, for the almost obvious reason that they could be jointed with the same material, so that the joint was at least as good a part as the other portion of the pipe. Iron pipes were always jointed with a different material, and, as a general rule, when they made a joint with a different material it sooner or later leaked. Iron pipes should never be allowed to be used inside houses for soil-pipes. He had spoken of the disadvantage of iron pipes as drain-pipes owing to their liability to rust. That disadvantage became more considerable when thay were used for waste and ventilation pipes, and if there was one thing he would warn his hearers against it was against ever allowing a ventilation-pipe to be made of iron, because he undertook to say that such a pipe after being in use for five years got blocked up at the bottom and did not ventilate the drain. In order to get rid of these disadvantages of iron-pipes various means of protecting the pipes had been resorted to. One was to cover the pipe with a material known as Dr. Angus Smith's solution, and another plan was to coat the pipes with an insoluble oxide. Pipes coated by this process were not universally used for sanitary work, because in the vast majority of cases the pipes protected with magnetic oxide of iron had defects in them. He had even seen pipes used for supplying houses with pure water specially prepared by this process taken out some two years afterwards because they leaked. They were simply eaten through and through by the pure water, and, therefore, they must always be on their guard against reliance upon processes for protecting a perishable material like iron. Until comparatively recent times lead pipes were made in the way in which the Romans made them, and were called "seamed" pipes. Now, they had pipes known as "drawn" lead-pipes, and these were a great improvement on the others, the soldered joint throughout the whole length of the pipe having been a source of weakness. Slip joints would not stand any test, and so the only proper joints for lead-pipes were wiped soldered joints.

Passing on to the consideration of the improvements made in the arrangement, trapping, and ventilation of drains and waste-pipes, the Professor said that not very long ago the drains of houses used to be made to end in receptacles called cesspools, and it was found necessary to prevent in some way or other the foul air getting into the house; therefore, the contrivance known as the "dip-stone" or "mason's trap" was devised. That trap sufficed, no doubt, to prevent a rush of foul air from the cesspool or sewer into the house; but it was a most defective contrivance, because, even if it did that, it allowed an enormous accumulation of foul matter to take place in the trap itself, which became a sort of small cesspool, and very often a large one. A "dip-stone" trap, whether large or small, was really a cesspool, and Yorkshiremen, with their characteristic love of truth, always called them cesspools. Another reason why that was a most defective contrivance was that the "dip-stone" and the stone at the top were in a very large number of instances not properly fitted. In those days, too, nobody thought of ever providing ventilation for the house-drain; if any was provided, it was by accident. The most essential improvement which had been made in regard to the trapping of drains was made after the adoption of stoneware drain-pipes by the construction of the siphon-trap. That was a very unfortunate name, because if it acted as a siphon it was not a trap at all, and he preferred to call it the "U" trap, from its shape. The improvement made in traps then was by making a bent pipe, and that improvement was due to the fact that it allowed less sediment, if any, to collect. They, therefore, came to recognise that the first important function a trap should possess was that it should not allow sediment to collect in it, and they laid down now as the one important characteristic of a good water trap that it should be self-cleansing. With regard to ventilation, in the first place, it was recognised to be necessary to provide something more than outlet ventilation for drains and soil-pipes. If they had merely outlet ventilation they only provided that foul air should not accumulate under pressure; but it was now a recognised necessity to provide a means for the inlet of fresh air into the drains and soil-pipes. If the ventilation-pipe at the top of the soil-pipe was carried up above the ridge of the roof into the open air, every wind that blew across it would cause an up-draught. The air inlets might be made, and were frequently made, by an open grating in the front area or outside the house; or by a pipe with open grating, often provided with a talc flap to prevent back-draught. In all sanitary appliances and apparatus an arrangement which did the work without any moving part was always better than one that did the work with a moving part. That was a good general law, and applied, for instance, to air-inlets and cowls which had no moving parts. Another important improvement was the provision of a manhole for access to the siphon-trap. It almost went without saying that drains ought not to be laid underneath houses if such a course could possibly be avoided. That very day he had seen a large house in the country underneath which he was informed a drain 70 ft. long was going to be laid. It was quite clear, therefore, that even now it was necessary to insist that, where practicable, drains should be laid outside of houses, and that soil-pipes should be placed against the outside walls, and not inside. Another matter of recent improvement was that drains and sewers should be laid as straight as possible. Until comparatively recent times the drains used to be laid where most convenient, without any idea of inspecting or cleansing them. Now, they insisted on having them laid as far as possible in straight lines. However, that could not always be done, and so it became the more necessary to provide means for inspecting the drains at different places. There were several ways of doing this, but the best way was to have inspection-chambers in the areas. Just as the drains required to be disconnected from the cesspools and sewers, so the waste-pipes of all the sinks and baths and lavatories required to be disconnected from the drains. That was one of the greatest improvements that had been made in "modern sanitation." It was necessary to have subsidiary ventilation-pipes, or anti-siphonage pipes, in the case of water-closets as well as sinks. In large houses, a great deal of greasy water and sand was thrown down the scullery sink, which solidified in the trap and drain, and blocked them up. It was necessary to provide against this, and the method adopted up to within the last two or three years was to construct what were known as fat or grease traps. These grease-traps were an abomination. They had to be cleaned out from time to time, and it was felt that if they could be done away with it would be a very great improvement. That had been achieved in modern times by the construction of a gully known as the grease-gully, which was large enough to hold sufficient water to chill any hot water that came into it. By means of an automatic flushing-tank, the grease and sand were washed away every day. The arrangement of water-closets against outside walls wherever possible, instead of in the middle of houses, might be regarded as a modern improvement. The improvements made in traps had been of the very greatest importance. The bell-trap had been replaced by the stoneware siphon-gully. The D-trap was at one time almost universally used for water-closets and sinks, but it had now been largely replaced by the round-made siphon or ∽-trap, which again had been improved by Mr. Hellyer, who had constructed what was known as the "anti-D-trap." Referring to the improvements made in water-closet apparatus, he remarked that the "short hopper" was a great modern improvement on the long hopper. The trap of a water-closet should not be regarded as part of the apparatus, but as part of the soil-pipe or drain, and they might unhesitatingly condemn all water-closets of which the trap was part of the apparatus. Other improvements which had taken place consisted in the re-substitution of the valve-closet for the pan-closet, and in the making of certain minor improvements, like the flushing-rim. Lastly, Professor Corfield exhibited an improved siphon-trap for deep disconnecting-chambers, provided with a valve by which the sewage could be easily allowed to escape in case of any blockage of the trap, which had been made by Messrs. Crapper & Co. at his suggestion.

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## PROFESSOR ARMSTRONG ON "THE DOMESTIC FIREPLACE."

The fourth lecture of the series was delivered on Wednesday, the 26th ult., by Professor Armstrong, Ph.D., F.R.S., his subject being "The Domestic Fireplace." Mr. Charles Barry, F.S.A., F.R.I.B.A., presided, and there was a large attendance.

Professor Armstrong said that the domestic fireplace justified that well-known adage that "Familiarity breeds contempt." They were so accustomed to it that, perhaps, they had got into the habit of considering too little whether they were constructing it properly. In these days, when they were taking stock of the efficiency of the machinery and processes which they made use of, there was a good deal that made it appear that the time had come when it was very desirable that some greater share of attention should be paid to this very simple contrivance. The domestic fireplace, in fact, was one of those time-honoured English institutions which, like most of our ancient institutions in these days of progress, had frequently of late been more or less called in question; but, like so many of our old-established practices, it proved on examination to embody sound theoretical principles which, in the opinion of capable judges, entitled it to survive. But it could not be denied that it was too often wasteful, and that, while ministering to our comfort within our houses, it was in a large measure the determining cause of the great discomfort which arises from the prevalence of fog in all our large cities. If the fireplace was to continue to enjoy our confidence, the objections to its use must be met, and this could only be done by those whose business it was to construct fireplaces, and by those who had to use them, learning to understand more fully than they did the nature of the changes which occurred in an ordinary fire. They had had "smoke-abatement exhibitions" all over the country, and at public meetings at the Mansion House and elsewhere the smoke-producer had been held up to universal execration; generally the comparatively guiltless manufacturer had been blamed, and the chief culprit,—at all events, in London,—the householder, had escaped notice. Only a few of the more far-seeing had pointed out the enormity of the aggregate effect of the petty misdeeds of which we were one and all guilty in this respect. It had been suggested that smoke-abatement should be made compulsory by Act of Parliament, not only in the case of manufacturers, who undoubtedly, as a rule, were in a position to minimise, if not to altogether avoid, the pro.

duction of smoke, although often with very considerable difficulty and at some extra expense, but also in the case of householders. He imagined, however,—and he thought those present would agree with him after hearing his argument,—that the only effect of such legislation would be to promote the business of purveyors of reputed smokeless grates. The fact was that the production of smoke was inseparable from the use of bituminous coal in our grates, and it was idle to pretend that it could be avoided. This was but insufficiently understood, however, although it had been clearly recognised, for instance, by no less an authority on sanitary matters than Sir Douglas Galton. Sir Douglas, in the course of a lecture delivered at the Smoke Abatement Exhibition in 1882, said—

> "Even if we succeeded in compelling all manufactories to consume their own smoke, we should still have a very plentiful supply of smoke in the air of London and of every large town from the domestic fires; and we may be certain that if the smoke from domestic fires were stopped, the manufactories would very soon follow the example, because the manufacturer is only one of the community, and smoke is allowed to exist because the community is not sufficiently educated as yet to realise the necessity of getting rid of it."

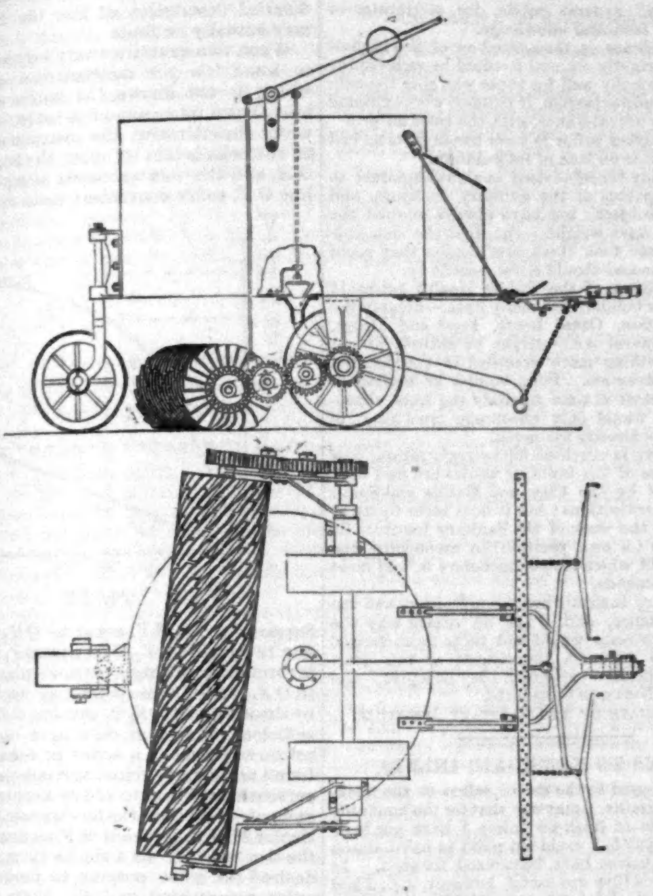
Sir Douglas Galton, both in that lecture and in a later lecture, delivered on December 1, 1887, at the Parkes Museum, had come to the conclusion,—which was the conclusion to which he (Professor Armstrong) desired to bring his hearers,—that there was no hope of solving the problem of getting rid of the nuisance unless they were content to abandon the use of bituminous coal. In order to make clear his first point,—that it was practically impossible to avoid producing smoke whatever grate they used so long as bituminous coal was burnt,—the lecturer pointed out that coal was the remains of the vegetation of ages long past, but of no ordinary vegetation. Most people knew how very differently logs or shavings of our common English woods,—beech, elm, or oak,—burnt in comparison with woods full of resin, such as pine. He illustrated the difference by burning pieces of ordinary cotton-wool and resin, and showed that the cotton-wool burnt with a perfectly smokeless flame, whereas the resin burnt with an intensely smoky flame. It might seem absurd to contrast such substances,—especially the wool,—with woods and coal; but, as a matter of fact, they were truly typical, inasmuch as vegetable structures generally largely consisted of what chemists called cellulose, which was known to them in an almost pure form in cotton-wool. In the case of most of our English woods the cellulose was not associated with resin, but most coniferous woods, such as pine, were rich in resin. The vegetation from which coal such as they usually burnt had been derived was, no doubt, highly charged with resinous matter, and when such coal was burnt it behaved very much as resin did. The consumption of coal in a fire was effected in two ways—at two distinct stages. In the first instance, the coal did not burn, if they used this expression in the sense in which it was commonly understood by chemists, but it underwent change in precisely the same way as it did when heated within a retort at the gasworks; its volatile constituents were given off: the contained resinous matters were volatilised, a complex series of changes taking place, and the volatile matters,—gases and vapours,—which were given off burnt with the bright smoky flame so familiar to and so loved by the Englishman. The coal which they usually burnt contained about 85 per cent. of combustible carbon, and 30 per cent., on the average, was volatile. The residual non-volatile matter or coke soon took fire, and, becoming red-hot, burnt away more or less rapidly provided the air had free access. Having illustrated the two stages by burning sugar and heating resin, the Professor proceeded to point out that the vapours which were given off in the first instance from coal were very much of the character of those which were produced on heating resin or bituminous shale, such as is so largely used in Scotland in the manufacture of lamp oils and paraffin. They were the vapours of hydrocarbons,—substances akin to ordinary petroleum and turpentine,—which burnt with a very smoky flame. Why did such substances burn with a bright smoky flame? The flame was bright in the first instance because it was smoky and *hot*. Vapours or gases which burned with smokeless flames did not give bright flames—alcohol, for instance. The flame was smoky because the hydrocarbons did not burn as wholes; the one constituent, the hydrogen, was more combustible than the other, the carbon. Unless the vapour were intimately mixed with sufficient air to secure its complete combustion, it was impossible, therefore, to prevent the separation of some of the carbon as smoke, and the conditions which obtained at the top of a fire were such that combustion must be incomplete and must involve production of smoke. To burn turpentine completely its vapour must be mixed with fourteen times its bulk of oxygen. But the oxygen in air was mixed with four times its bulk of nitrogen, a perfectly inert gas, so $14+(4\times 14)=70$ times its bulk of air at least must be mixed with the turpentine vapour. They succeeded in burning gas and petroleum without smoke production by very carefully so arranging the rate of burning, and so adjusting the supply of air, that complete combustion was secured. The gas flame had the form of a thin flat or circular sheet given to it, and a great surface was thereby presented by it to the air; and in a petroleum lamp not only was a particular shape of flame secured, but air was supplied by creating a draught round the flame by means of a chimney of proper size. Such arrangements could not very well be made, however, in the case of a fire. They could not well fix a glass chimney over it, and they had also to bear in mind that only one face of the fire was exposed to the air. In the case of a gas flame every face was exposed to the air. The combustion of vapours of hydrocarbons was rendered incomplete not only by the insufficient supply of air, but also by the cooling effect of air present in excess. When the carbon was once separated in the form of smoke it was very difficult to burn it. They were accustomed to think that carbon was a very combustible substance, but their ideas on that subject had undergone a complete change within the last few years: thus they had learned that the burning of the carbon was dependent upon water vapour being present. Hence it would be seen that many influences were at work in a fire to render combustion incomplete. In the first place, there was the shape of the flame; in the second place, the dilution of the combustible gases by the products of combustion from the fire below; and in the third place the inrush of cold air, tending to produce the cooling effect to which he had alluded, rushing up the chimney. What remedies had been applied in order to meet these difficulties? How did the manufacturer prevent smoke? In the first place by never doing as they did in their domestic fireplaces—pitching on a scuttleful of coals. He fed in fuel gradually, and was careful to introduce air not only from below, through the bars of his furnace, but also above the fire at a point some distance beyond that at which the distillation went on. In the care of the domestic fireplace, the difficulty had been met by putting coal into a hopper at the back of the fire, or by feeding it in underneath, so that the volatile substances passed up through the fire. That was one method, and probably the most efficient method that had been contrived for getting rid of the smoke; but such an arrangement was only effective when they had got a good roaring red-hot fire. The harm was chiefly done in the morning when the fire was lit, and unless cinders were then used they could not prevent smoke being given off in the first instance. Another method was to introduce a sloping back and baffle-plate. A form of grate was described which was supposed to be a smoke-preventing one, having an air-chamber at the back of the fire, the idea being to burn the hydrocarbons at the top of the fire by bringing them into contact with fresh air. Such an arrangement might produce a certain amount of effect, but it could not produce any great result. In the official report of the Smoke Abatement Committee of the Exhibition of 1882, the results of a series of tests made with a considerable number of grates with reference to the prevention of smoke were given, and the difference between the worst and the best, after all, was very little. The worst had an average smoke shade of 3·2, and the best 2·6, so that after all the improvement was not very great. It followed, therefore, that bituminous coal must be abandoned if they wished to avoid smoke; they must be content to sacrifice the bright, cheerful flame over the top of the fire. It was one of those cases in which they could not have their cake and eat it. They did not want to raise the temperature of the air in rooms to any considerable extent, because, in the first place, hot air was unpleasant to breathe, and, in the second place, because hot air produced an unpleasant effect on the skin. What they did want in their English system was to heat all the surrounding objects to such a temperature that heat radiated from them to persons in the room, instead of the heat radiating towards them. The lecturer proceeded to deal with the second stage, namely, the stage at which true combustion takes place in a fire. What happened? There was no production of smoke possible under these conditions, but there might be loss owing to incomplete combustion, caused either by an insufficient or an excessive supply of air. Most of the grates in use in recent years were excessively wasteful, they either gave what everyone knew under the name of a black fire, and therefore did not radiate sufficient heat into the room, or excessive draught caused too rapid conbustion, and great waste in consequence. The modern slow-combustion stoves were an enormous improvement in this respect. Care was taken to carry on combustion at as slow a rate as possible in order to secure a good result, and that was done mainly by checking the draft. There was not the least doubt that the mere introduction of a small baffle-plate was the secret of the success which had attended the introduction of modern stoves. The modern stoves were also very much better in the sense that all superfluous iron-work which tended to take away heat had been got rid of; any stove might be made a slow-combustion stove, in the very simple manner advocated by Mr. Pridgin Teale in his book, "Economy of Coal in House Fires." He had said that if they were to get rid of smoke at all, they must abandon the use of smoky coal. What, then, were they to use? They must use anthracite coal or coke. A good many people had had experience of these two forms of heating, and, he thought, were quite prepared to make use of them, but there were many who had sentimental objections, on the score that such fires had no bright flame playing over them. He himself during the last two years had been burning practically nothing but coke, and to him such a fire was certainly as cheerful as any ordinary fire. People generally, however, objected to the use of coke, and there was no doubt that it did require a certain amount of education. The most successful coke fire he had was one he made with a few bricks and a gridiron with very narrow bars as a front. That stove was capable of always exhibiting a perfectly brilliant red-hot face, provided the fire was not allowed to burn too low. It should be mentioned that Sir Douglas Galton, in the lecture he had previously referred to, said:—

> "An open fire of smokeless coal, although it may have a glow, is not generally such a cheerful fire as a fire of bituminous coal; and, without care and a rapid draught, which is rarely attainable in the existing open fire-place, carbonic oxide is liable to be formed, and to come into the room."

He (Professor Armstrong) did not think these objections were serious. Architects as a rule had not been in the habit of providing ventilation in our houses; the air was allowed to come in where it liked. But if the architect were to provide for the admission of air into the room at all times the objection would be dissipated. There was one other point to be called attention to in regard to the burning of smokeless coal and fuel, viz., that if they were to make some arrangement by which the air introduced at the front of the fire could be made hot they might secure a hotter fire. There were very many other points which, if time permitted, might be entered upon with advantage, but he would conclude by expressing the hope that he had succeeded in bringing home the one point which he was anxious to make, that so long as they used coal containing volatile matter they could not hope by any practical arrangement to prevent smoke.

The fifth of this series of lectures was delivered on Wednesday evening last by Professor A. B. W. Kennedy, F.R.S., his subject being "The Forth Bridge," illustrated by a series of lantern views. Mr. Alfred Preston presided, and there was a crowded attendance.

**The London County Council.**—There was no business of special interest to our readers generally transacted at Tuesday's meeting of the London County Council, which was mainly occupied with a discussion of the provisions of the Bill promoted by the Council for the regulation and control of theatres and music-halls.



*The "Hercules" Street-cleansing Machine.*

## THE "HERCULES" STREET-CLEANSING MACHINE.

We recently had an opportunity of being present at some trials of this machine on the roadways of Victoria-street, Westminster, and some adjacent streets in the locality. The *locale* was well chosen for such a purpose, for on the authority of Mr. Strachan, late Surveyor to the Chelsea Vestry, supported by our own observation, "as plentiful as mud in Victoria-street" is fast becoming not only a synonym for abundance, but a reflection on the scavenging operations of the local authority; whilst it is also somewhat of a satire on the municipal and other engineers whose offices so thickly stud this part of London.

The trials which we witnessed were very successful, and proved the capacity of the machine, which appears to be equally well suited for either asphalte, wood, or stone paving,—for any kind of road, in fact, but macadam. As will be seen by the accompanying illustration, the machine, briefly described, consists of a circular water-tank, with a revolving brush beneath it, there being a water-pipe or spreader pierced with fine holes, which travels in advance of the brush, and facilitates the operations of the latter. It seems to be quite clear to us that the continual use of this machine would not only keep our town streets clean and free from dust, but that it would confer a great boon on the horses, whose struggles and sufferings of late have been painful to witness, owing to the stiff, glutinous, pasty, greasy mud, which is very disgracefully allowed to accumulate with little or no attempt to remove it, being mostly left alone until the rain comes to wash it away. We are speaking of leading thoroughfares, such as Holborn, the Strand, Fleet-street, and Ludgate-hill. The sooner the local authorities adopt the lesson so clearly demonstrated by this machine, and use water in conjunction with the scavenger's brush for street cleansing, the better it will be for the public and their hardly-treated helpers, the horses.

**Change of Address.**—The United Asbestos Company, Limited, have removed from Queen Victoria-street to more commodious premises at Dock House, Billiter-street, London, E.C., lately in the occupation of the East and West India Dock Company.

## ARCHITECTURAL SOCIETIES.

*Birmingham Architectural Association.*—At a meeting of this Association, held on the 21st ult., under the chairmanship of Mr. T. Naden, Mr. W. H. Kendrick read a paper entitled "Notes on Woodwork," which had been jointly composed by Mr. H. H. McConnal, A.R.I.B.A., and Mr. Kendrick. After a brief account of the history of the craft of the joiner, Mr. Kendrick described some local examples of his art, amongst them being the fine timber-built house of "The Oaks," at West Bromwich, which retains its artistic masses and outline and its delicately-finished details as designed by its original designer without any intervention on the part of the present day restorer. The internal fittings of Tong Church, near Shifnal, with its fine screens and beautiful stalls, which are particularly noteworthy for their harmony as a whole and for the everywhere varied detail of the parts and the screen in the south aisle of Hamstall Ridware Church were given as examples of Gothic joiners' work in parish churches, and the west gallery in St. Peter's Church, Wolverhampton, as a typical example of seventeenth century work. The Bishop's throne in Lichfield Cathedral, of seventeenth century work, and probably erected by Bishop Hacket, was chosen as a final example of the noble woodwork of that period, and as being, with a few bench-ends, the sole remains of Bishop Hacket's fifty-stalls which had survived Wyatt's various efforts to beautify the cathedral. The paper was illustrated by a large number of exceptionally interesting drawings of these and other examples of woodwork in the district prepared by Messrs. Kendrick and McConnal.

*Leeds and Yorkshire Architectural Society.*—"The Revival of Applied Art" was the title of a lecture delivered before the members of the Leeds and Yorkshire Architectural Society, in the Law Institute, Leeds, on Monday evening, by Mr. Mervyn Macartney. Of the revival of applied art in England, said the lecturer, there was certainly no doubt so far as painting, sculpture, and architecture were concerned. Larger fortunes were made in those arts now in this country than ever before. But that did not necessarily show that the various arts were in a more flourishing condition than formerly. Painting was, or had been up to quite a recent date, very prosperous, as regarded material prosperity. That success was to some extent owing to State patronage, and to artists producing what was eminently adapted to the wants of the present. The revival in sculpture was due largely to the same cause. Relatively sculptors had reached the highest average of excellence; and that, too, in spite of their being followers almost to a man of the Classic school, and not the popular realism of the Italians. As to architecture, he believed that there were never so many real architects as at the present day. He dwelt upon the relation of those arts to applied art, and referred to the dependence of the decorative crafts on architecture. People had found out that there was often more beauty in the thousand and one objects of every-day use than in the paintings that adorned their walls or the statues that graced the hall.

*Liverpool Architectural Society.*—At the meeting of this Society on Monday evening last a paper was read by Mr. James M. Hay on the "Decorative Panels of St. George's Hall." The history of the panels was given from the time when the first panel was set up in 1885, the adverse criticisms which it drew forth from all sides, its disapproval by the Council of this Society, and its forwarding the same to the City Council; the setting up of the second panel, and (for the first and only time) a description of the work and the intentions of the sculptor from the pen of Professor Conway, published in the *Liverpool Daily Post* in December, 1887. Mr. Hay strongly criticised the panels, which, he contended, ought to have been in high relief, and attached to the field of the panel, not set on a shelf or ledge. The figures are too tall for the place they occupy, and there is a paucity of oblique lines in the composition. The figure of Joy should have been merrily skipping along in front of the procession, strewing her flowers, and not standing sulking in the rear. The nude in both panels is forced and unnatural, and instead of heightening, seriously detracts from artistic expression. If the child Justice, in the first panel, had been provided with a short skirt, and the naked female figure in the second clothed in the fine Classic tunic of the Greeks, veiling without concealing the beauty of the form, the idea of "purity" would have been better symbolised, the art would have been finer, and public decency would not have been outraged. The work altogether betrays the pernicious influences of the realistic school that is doing so much in France to degrade both her literature and her art. Allusion was made to the generous and public-spirited offer of Mr. Philip Rathbone to pay the expense of completing the four remaining panels of the series. But Mr. Rathbone forgot that it was not the cost, but the unfitness of the panels that prompted the City Council to discontinue the work, and this the generous offer in no way changes. It was inconceivable that a Corporation which has spent 300,000*l.* on a building would grudge a paltry thousand towards its completion. In conclusion, he considered that it was an injustice to one of the finest buildings in the city that those panels should remain a patch and disfigurement on the face of it; that it was an injustice to the memory and fair fame of Elmes; that it was an injustice to the citizens of Liverpool, and an outrage to public decency; and that they should respectfully ask the City Council to take immediate steps to have the offending panels removed and the stone imbosts restored before any further arrangement was entered into with any sculptor.—A discussion followed, but no practical result was arrived at. [We print a *resumé* of the paper, to show what some Liverpool critics are capable of in regard to this matter. The idea that the French, who are far at the head of the whole world in imaginative sculpture, are degrading the art by realism, is truly delightful.]

**Sam Deards & Co., Limited.**—The report of the Directors of this Company, submitted to the shareholders at the first annual general meeting, held on Monday, the 24th ult., congratulates the shareholders on the accounts showing a profit of nearly 12½ per cent., after paying all expenses and allowing for depreciation of the patents, &c. The Directors, having regard to future operations of the Company, recommended that a dividend of 7½ per cent. be declared, and that the balance be carried forward. We are asked to add that the unallotted shares in the Company are being issued, and any one applying for same must do so at once to the London offices of the Company.

## BUILDERS' CLERKS' BENEVOLENT INSTITUTION.

The twenty-third annual general meeting of the donors and subscribers took place on Tuesday, March 4, at 21, New Bridge-street, E.C., Mr. H. H. Bartlett (President-elect) occupying the chair, supported by Mr. E. Brooks (Treasurer), Messrs. E. C. Roe, H. W. Parker, C. K. Turpin, J. Robson, T. H. Winny, E. B. Gammon, A. A. Stanger, W. D. Gilbert, and other gentlemen.

Mr. Wheatley, the Secretary, read the report, which stated that during the past year the income had been well maintained, the amounts being 288*l*. 12s. annual subscriptions, 317*l*. 19s. donations, and 98*l*. 7s. 5d. dividends; total, 704*l*. 18s. 5d. The expenditure was 472*l*. 11s. 7d., of which amount 377*l*. 18s. 4d. was for pensions and temporary relief. Two elections had been held, the result being that Mrs. Charlotte Tucker and Mrs. Susan H. Fisher had been added to the pension-list. One pensioner, Mr. J. T. B. Miles, had died during the year, leaving a present total of nineteen pensioners now on the books, and three children at the Orphan Working School, per presentation of the Institution. The eleventh annual dinner took place at the Holborn Restaurant on April 2, 1889, Mr. John Aird, M.P., presiding. The attendance was very large, more than filling the Venetian Chamber, and, as the result of the Chairman's appeal, subscriptions and donations were announced amounting to 350*l*. This sum included a large number of contributions from builders' clerks themselves. The Committee return their best thanks to Mr. Aird for his kindness in having served the Institution as President, and for his handsome assistance in support of the funds. A further purchase of stock had been made during the year, bringing up the total of invested funds to 3,650*l*. The committee announce with great regret the death of Mr. Charles Richardson, one of the trustees, and also a vice-president of the Institution. Mr. Richardson had been a regular and liberal supporter of the funds from the foundation to the period of his lamented decease. The report concluded by thanking the master builders, architects, and merchants connected with the building trade for their past help, and by expressing the hope that the same would be continued, to the end that the usefulness of the Institution might be well maintained.

The Chairman, in moving the adoption of the report, expressed the pleasure it gave him to meet the subscribers and donors, and to find the Institution in such a flourishing condition. Much had been done during the past year in assisting widows and those who needed relief, additional funds had been invested, and the balance at the bank was satisfactory. He hoped to do what he could for the welfare of the Institution, and trusted that at the close of his year of office the funds would not be in a less satisfactory state than at present. He had much pleasure in proposing "That the report and balance-sheets, as read, be adopted and printed, together with the list of subscribers and rules of the Institution."

Mr. E. B. Gammon seconded the resolution, which was put from the chair and duly carried.

Mr. E. C. Roe, in proposing a vote of thanks to the ex-President and other retiring officers, remarked that Mr. Aird's parliamentary and other duties had prevented his attendance at the ordinary committee meetings, but he had done the Institution good service in having acted as President. As to the future, there was one thing to consider with reference to the increasing number of pensioners, and that was the importance of adding to the invested funds, so that a steady income might arise from that source.

Mr. Stanger seconded the motion, which was carried, Mr. C. Brown replying on behalf of Mr. Aird and the other retiring officers.

Officers for the present year were then elected, and Mr. Brooks (the Treasurer) spoke in complimentary terms of Mr. Bartlett, who headed the list, and also referred to the valuable services rendered by some of the members who had already served, and whose names were included amongst those re-elected that evening.

On the motion of Mr. Gilbert, seconded by Mr. Stansfeld, a vote of thanks was presented to the Chairman, who, in replying, said that although he was a busy man, with not much time to spare, he yet hoped to come amongst them, and what he could do to the help of the Institution he would do with pleasure.

The proceedings then terminated.

## BUILDERS AND THE SANITARY INSTITUTE.

Sir,—I feel sure that the remarks of "Builder and Decorator" in your last issue [p. 158] will meet with approval, and for one I wish to give more than tacit assent to the same by now and thus expressing my agreement with him as to the good policy (say nothing of more sentimental reasons) of the Sanitary Institute providing such a curriculum as to meet the requirements of various trades, and at the same time satisfy the demand so rife at the present moment, which is made by both the young "go-with-the-times" tradesman and the "alive-to-its-own-interests" general public, for certificates or evidences of technical knowledge.

Sanitary science is recognised as of the highest importance (rightly so), and it would be well for the public, and equally well for those who give the subject their careful attention, if builders were expected to have more acquaintance with the rules ad principles, which often suffer in their hands, from no bad intention, but from lack of information.

I have many times advised anxious inquirers to get the prospectus of the Sanitary Institute, and take up the subject; but have always allowed the objection to have weight,—viz., that the demands of the Institute took them over studies they could not appreciate and should never benefit by.

Whole sections of the Public Health Act could be spared the builder, and many Acts,—notably the Rivers Pollution, Canal Boats, Food and Drugs, Nuisance Removal, &c.,—might be entirely passed over for something more practical in the shape of building construction. For a builder or tradesman it would be waste of time to study the Acts above-named, and would only encourage *cramming*, of which there is already too much.

The plumber is provided for by registration, and other branches of the building trades are met with similar helps by the City and Guilds and South Kensington Institutions; but it does seem to me to be eminently the work of the Sanitary Institute (if it will rise to its own position) to monopolise the particular field which is opening before it, and meet the public demands.

The Sanitary Institute has the machinery and the public confidence, and I see no reason why the builder's certificate would not be as much sought after and be as much appreciated as the ever-growing and popular one which they now give,—the Inspector of Nuisance Certificate.

An Associate of the Sanitary Institute.

## VALVES TO FRESH-AIR INLETS.

Sir,—In regard to the use of valves on the fresh-air inlets to drains, I may say that for the hundreds and thousands of fresh-air inlets I have put in or caused to be put in I could not point to half-a-dozen cases where valves have been used for such. In some odd cases they are useful, however, *e.g.*, I had a side fresh-air inlet into one of my traps for a drain where the inlet grating was on the ground beside a lawn-tennis green. In that case it was considered advisable to put in a valve to let air in but to shut against air coming out. In cases where the fresh-air inlet is in the face of the wall of house, say, about a foot above ground, and close to a door or window, or between both and close to them, then it is a good precaution to put in a valve, but such need not be dead-tight. W. P. Buchan.

*Glasgow*, March 1, 1890.

# The Student's Column.

## ELECTRICITY, MAGNETISM, AND ELECTRICITY SUPPLY.—X.

### Law of the Electro-Magnet.

The simplest form of electro-magnet consists of a cylindrical bar of soft iron, surrounded by coils of insulated wire. When a field as intense as possible, but of limited volume, is required for practical purposes, the bar is bent into the horse-shoe form, with the ends facing each other, and the flux between these two polar faces made use of.

Many endeavours have been made to find some simple relation between the ampere-turns in the coil or coils and the strength of the magnet produced by them.* Dr. John Hopkinson published the results of a valuable investigation on this subject in 1885. It is disappointing to find that apparently before it would be possible to predict, with absolute accuracy, to what extent a given number of ampere-turns would magnetise a piece of iron, the whole previous history of the metal would have to be known. It is, however, possible, by taking mean values, to easily arrive at results which are very near the truth, and which are, moreover, sufficiently accurate for practical engineering purposes. What, therefore, is given as the law of the electro-magnet must be accepted with this reservation.

The field produced by an electro-magnet at any point can be measured in various ways, for instance the strength of the field of a dynamo-machine can be determined by finding the electro-motive force set up in its moving conductors as they cut the lines of force with a known velocity; or the field may be compared with one of known strength by means of an ordinary magnetometer. As, however, full descriptions are to be found in all books specially devoted to practical electrical and magnetic measurements, it is unnecessary to give here any detailed description of how the measurement may actually be made.

When two quantities vary together according to some law the mathematical equation for which is not known, the results obtained are best shown by means of a curve. In the case under consideration the magneto-motive force of the coils is laid off along the horizontal line O X, and the flux produced along the vertical line O Y, some convenient scale being chosen.

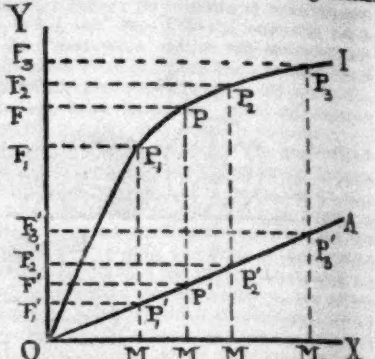


*Fig.* 24.

Suppose an M.M.F. equal to O $M_1$ produces a flux to equal to O $F_1$, then a point $P_1$ in the curve is formed by raising a perpendicular $M_1$ $P_1$ equal to O $F_1$, or the same point may obviously be got by drawing at $F_1$, $F_1$ $P_1$ equal to O $M_1$. When a sufficient number of data have been got from actual experiment a series of these points are found and a curve drawn through them. Such a curve will enable us to find by means of a T-square and pair of dividers the flux produced by any particular M.M.F. or the M.M.F. required to produce the flux needed. As a simple example, let it be desired for some purpose to produce a flux of value represented by O F. With the dividers measure off the length O F along O Y, by means of the T-square draw a perpendicular through F until it cuts the curve in P, then F P is the M.M.F. required to produce the flux wanted. The equation expressing the relation between M.M.F. and flux is the equation to the curve in rectangular co-ordinates. What this equation is has yet to be found, and when found it will be too complicated to be of very much practical use, although certain approximate expressions are of service to those who do not care to use graphical methods. In the figure only three points, $P_1$ $P_2$ $P_3$, are drawn; it would, of course, be impossible in practice to accurately draw the curve through but three points; a great many more experiments than three must be made.

The curve of magnetisation for the electro-magnet having been found, remove the iron core and determine the points $P_1$ $P_2$ $P_3$ for the "air core"; it will be found that the flux is in each case much less than when the iron was present, but that the curve for air is a straight line, since $O M_1 : O M_2 : O M_3 :: M_1 P_1' : M_2 P_2' : M_3 P_3'$.

The results shown, recorded by means of the straight line O A with air alone, and the curved line O I with iron placed inside the coils, must now be considered in connexion with the magnetic circuit; the form of magnet shown in fig. 25 is made to closely represent a portion of a circuit such as is to be found in practically all dynamo-machines and will, therefore, be of use when considering the actions of these machines at a later period. Everyone who has been to any industrial exhibition of late years must be familiar with the general appearance of the dynamos that are always on view. Apart from details, a dynamo-machine consists essentially of two parts, the field-magnets and the armature. As a rule, the magnets are attached to the bed of the machine, while the armature revolves; but, since relative motion alone is necessary, some makers prefer to keep the armature stationary and revolve the field. The field magnet or magnets, to which we shall

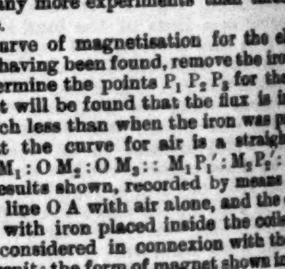


*Fig.* 25.

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* An interesting summary of the formulæ suggested by various investigators is given in Thompson's "Dynamo-Electric Machinery."

at present confine our attention, consists of a single horse-shoe, or is built up of a combination of such magnets. Fig. 25 may therefore be taken as an elementary form of this part of a dynamo; it represents an iron core of uniform cross section (S) bent so that the polar faces are opposite each other, the limbs being wound with suitable coils of insulated wire.

Returning to fig. 24. We may suppose that the points on O A were obtained from experiments on the coils alone, before they had been placed on the iron cores. Let M = M.M.F. in any one experiment, F′ the flux, and R′ the magnetic resistance of the air throughout the circuit, thus:—

$$R' = \frac{M}{F'}$$

but when air alone was in the circuit, $\frac{M}{F'}$ was found to be a constant, no matter how the values of M and F′ are varied, hence the specific magnetic resistance of air is independent of the flux passing through it. When, however, the iron cores are in use the points $P_1 P_2 P_3$, &c., do not lie in a straight line, but along a curve O I, and the general shape of this curve shows that the magnetic resistance of iron increases as the flux passing through it increases. In other words, the value of $\mu$ for iron decreases as the metal becomes more intensely magnetised.

Since the resistance of any circuit is equal to the M.M.F. divided by the flux, the resistance in any particular case can be found; if from this be subtracted the resistance of the air, the remainder will clearly be that of the iron, and from the quantity so obtained the value of $\mu$ can be easily got by means of the formula already given. As, however, the calculation of the air-resistance presents mathematical difficulties owing to the way the lines of force spread out in curves, it is customary in making experimental determinations of the value of $\mu$ on a sample of iron for different degrees of magnetisation to make the circuit as nearly as possible entirely of iron, only a comparatively narrow slit of air-space being left for the purpose of getting at the flux to measure it. Since the lines of force will go nearly straight across the air-space, its resistance can be allowed for, and only an extremely small error introduced.

This subject is of such pre-eminent importance that it is worth while to give a numerical example by way of illustration. In fig. 25 suppose the core of the magnet to be made of a bar of annealed wrought-iron, of which the cross-section (S) is 5 square centimetres, and the average length ($l_1$) 20 centimetres. Between the poles of the magnet is placed a little block, 2 centimetres long ($l_2$), cut from the same bar, the air-space on each side being ($d$) 0·1 centimetres across. We will calculate how many ampere-turns (A) will be required to send a flux of 36,000 lines through the block. Two assumptions, neither of them perfectly true, will be made—firstly, that lines of force which go across the air-spaces are straight; secondly, that lines do not leak across the limbs of the magnet. Employing the symbols already used, the resistance of the iron portion of the circuit is $\frac{l_1 + l_2}{\mu S}$ that of the two air-spaces $\frac{2d}{S}$ hence

$$F = \frac{4\pi A \div 10}{\frac{l_1 + l_2}{\mu S} + \frac{2d}{S}}$$

that is, the flux is equal to the M.M.F. set up by the coils, $4\pi A \div 10$, divided by the total magnetic resistance of the circuit, or

$$A = \frac{10 F}{4\pi S}\left\{\frac{l_1 + l_2}{\mu} + 2d\right\} \text{.........(1)}$$

Now, F is to be 36,000, that is, 9,000 lines per square centimetre, and, on referring to tables of experimental results, it will be found that under these conditions the value of $\mu$ for annealed wrought-iron is about 2,250, substituting these various values in equation (1).

$$A = \frac{10 \times 36000}{4 \times 3{\cdot}142 \times 5}\left\{\frac{20+2}{2250} + (2 \times 0{\cdot}1)\right\}$$

$$= \frac{18000}{3{\cdot}142} \times \frac{472}{2250}$$

$$\begin{array}{ll} \log 18000 = 4{\cdot}2553 & \\ \log \quad 472 = 2{\cdot}6739 & \\ \hline & 6{\cdot}9292 \\ \log 3{\cdot}142 = 0{\cdot}4972 & \\ \log \quad 2250 = 3{\cdot}3522 & \\ \hline & 3{\cdot}8491 \\ \hline & 3{\cdot}0798 = \log 1201 \end{array}$$

$$\therefore A = 1201$$

## RECENT PATENTS.

### ABSTRACTS OF SPECIFICATIONS.

**4,598, Marble-pattern Papers. W. B. Blaikie and Others.**

This invention comprises a new or improved system for producing marble-pattern or such like papers by printing them from metal plates or blocks made so as to give a finer effect than the ordinary mode of producing such blocks, and to enable the same pattern to be represented any number of times and in any variety of colour, and with lines, shadows, or relief effects. The printing-blocks are of soft metal, run so as to produce a mottled or marble effect.

**4,958, Glazed Structures and Sash-bars. W. Lindsay.**

The sash-bars, which are the subject of the patent, are made with ratchet-like teeth projections or corrugations upon the rib, serving to give a better hold to the putty, or with enlargements along the outer edge of the rib of the sash-bar for a similar purpose and to support strut-pieces. In glazed structures the glass is sometimes held in place by the strut-pieces so attached.

**5,083, Improvements in Water-closets. W. Dunn.**

The object of this invention is to construct water-closets in such a manner that they occupy but little space and can be hidden from view when not used. The pan and seat are hinged to the upper part of the syphon or water-seal trap by means of a horizontal axle and butt-hinge placed immediately underneath the pan, and the sides of the syphon extend upwards beyond the hinge, so as to overlap and cover the sides of the pan. A flushing-basin is fitted above the pan and fits into it when the latter is turned up into its vertical or folding position. The whole apparatus is preferably enclosed in a rectangular frame fixed in a recess in the wall.

**6,152, Ventilator. W. C. Williams.**

According to this invention, an ornamental and efficient ventilator is made of earthenware or iron; the outer face being an ornamental plate with openings, and in the centre an ornamental solid piece with two arms which act as deflectors; the inner part is of a box-like form at each end, with a passage out towards the centre. The air blowing straight against the ventilator is deflected by the wings, and passes around each of the chambers before it can pass through the central passage into the buildings.

**19,511, Bench Plane. J. Crane and W. H. Windle.**

The plane-iron, which is the subject of this patent, is secured by a lever, which, falling down in the front of the body of the plane, forms a forward handle, while the plane is worked by this and a wood handle at the back end of the plane. The cutting-irons are immediately released on raising the handle or lever.

**20,452, Metallic Lathing. G. Hayes.**

In order to better hold the plaster, the metallic sheet is, by this invention, stamped or punctured with holes, to each of which two small tongues or strips of metal are made by the process of punching out. These tongues, being bent into a hook or clip form, serve to retain the plaster, which, when applied, completely surrounds them, so that they become embedded therein. The plaster also sets into the apertures, and, protruding at the back of the lath, forms into knobs or buttons, thus affording a more secure hold.

### NEW APPLICATIONS FOR PATENTS.

*February* 17.—2,536, C. Thomerson, Sheet Metal Roofing.—2,542, F. Bird, Sewer Ventilation Columns or Shafts.—2,560, R. & F. Ambrose, Window Sashes and Frames.

*February* 18.—2,570, J. Walford, Wedge for Securing Windows, Doors, &c.—2,609, C. Rogers, Screw Nails.—2,619, J. Schultz & E. Hopf, Flooring for Roofs, Terraces, &c.—2,625, J. Stevens & T. Birch, Weather Bars for Casement Sills.

*February* 19.—2,682, J. Sloan and E. Bell, Anti-fouling or Preservative Paints.—2,695, H. Haidan, Ventilating and Cooling Cellars, Rooms, &c.

*February* 20.—2,721, W. Fryer, Portable Stoves for removing Old Paint, &c.—2,739, E. Ingham, Draught Preventers for Doors.

*February* 21.—2,787, E. Seddon, Apparatus for Sand-papering Wood.—2,806, A. Bowie, Window fastenings.—2,808, W. Noad, White Lead.—2,828 R. Friend, Opening and Closing Skylights, Casements, Fanlights, &c.—2,841, R. Milde, Dwelling and other Houses.

*February* 22.—2,858, M. Syer, Syphon Cisterns.—2,862, J. Williamson, Door and Gate Latches.—2,879, J. Line, Pattern Book for Wall and Ceiling Papers.—2,881, J. Offord, T-Squares, &c.—2,896, W. Joy, Manufacturer of Cement.—2,900, P. Bawden, Machinery for making Bricks and Tiles.

### PROVISIONAL SPECIFICATIONS ACCEPTED.

608, J. Becker, Scaffolding.—1,074, W. Ellis, Cutting Wood for Lathes, &c.—1,139, Hurdle, Self-lubricating Pulleys for Window-sashes, &c.—1,379, J. Jepson, Locks for Gates and Doors.—1,527, T. Jones, Gas-fitters' Blow-pipes.—1,908, R. Wilford, Screw-fastenings for Windows.—2,021, S. & W. Dearden, Cutting Stone, &c.—2,077, E. Barlow, Water, Gas, and Drain Pipes, and Joints for same.—2,169, W. Barnes, Joiners' Cramp or Flooring.

### COMPLETE SPECIFICATIONS ACCEPTED.

*Open to Opposition for Two Months.*

6,555, H. Allan, Kitchen Ranges.—6,603, I. Serginson & J. Noble, Chimney Cowl.—6,760, J. Sizer, Fire-grates and Stoves.—6,815, R. McIvor and others, White Lead.—12,232, E. Olander, Floor Plates and Floors for Bridges, &c.—915, E. Norton, Paint-cans.—946, J. Radford, Securing Door-knobs to their spindles.—1,095, E. Smith, Veneer-cutting Machines.

## RECENT SALES OF PROPERTY:

### ESTATE EXCHANGE REPORT.

| | |
|---|---|
| FEB. 24.—By WILKINSON & SON. | |
| Balham—7 to 10, Victoria-ter., u.t. 80 yrs., g.r. £32, r. £105 | £850 |
| Bethnal Green—5 and 7, Warley-st., f. | 500 |
| By SLEE & SON. | |
| Islington—15 and 16, Waterloo-ter., u.t. 42 yrs., g.r. £13, r. £72 p.a. | 520 |
| 18, 20, and 22, Barnsbury-grove, u.t. 64 yrs., g.r. £15, r. £111 | 810 |
| By T. WAKEFIELD. | |
| Bloomsbury—3, Montagu-mews, u.t. 9 yrs., no g.r. | 230 |
| Islington—19 and 21, Blundell-st., u.t. 60 yrs., g.r. £12 | 330 |
| By BEARD & SON. | |
| Hammersmith—11 and 12, Argyle-pl., u.t. 80 yrs., r. £45. 10s. | 225 |
| Chiswick—3, 4, and 5, British-grove, u.t. 17 yrs., deductions £36, r. £70 | 150 |
| FEB. 25.—By DEBENHAM, TEWSON, & CO. | |
| Strand—14, Buckingham-st., f., area 3,821 ft. | 10,500 |
| Hyde-pk.—I.g.r. of £35, u.t. 44 yrs., subject to a g.r. of £2 | 610 |
| I.g.r. of £109, u.t. 44 yrs., free of g.r. | 1,975 |
| I.g.r. of £28. 17s., u.t. 44 yrs., free of g.r. | 470 |
| Lewisham—I.g.r. of £47. 10s., u.t. 76 yrs., subject to a g.r. of £4 | 860 |
| By J. DAWSON & SON. | |
| Hammersmith, Queen-street.—The residences "Temple Lodge" and "Roseneath," f., about 1½ acres | 5,020 |
| By BOYTON & PEGRAM. | |
| Walham Green—2, Tournay-rd., u.t. 90 yrs., g.r. £7, r. £38 | 350 |
| 1, Chapel-ter., u.t. 97 yrs., g.r. £7. 10s. | 350 |
| Fulham—30 to 36, Ewald-rd., u.t. 96 yrs., g.r. £20, r. £104 p.a. | 605 |
| By F. J. BISLEY. | |
| Bermondsey—85, Jamaica-rd., f., r. £40 p.a. | 495 |
| 26 and 28, Strathnairn-st., u.t. 47 yrs., g.r. £10, r. £66 | 505 |
| 192 and 194, Fort-rd., u.t. 47 yrs., g.r. £10, r. £67. 10s. | 585 |
| FEB. 26.—By A. WATSON. | |
| Greenwich—6 and 8, Horseferry-rd., f., r. £42, and a ground-rent of £3, with reversion in 15 yrs. | 530 |
| 28, Deacon-ter., u.t. 19 yrs., g.r. £2. 8s., r. £23. 8s. | 95 |
| By R. TIDY & SON. | |
| Kingsland—5 and 13, Ardleigh-rd., u.t. 34 yrs., g.r. £11, r. £65 | 490 |
| By W. R. SMITH. | |
| Old Kent-rd.—39 to 45 (odd), Asylum-rd., u.t. 19 yrs., g.r. £13. 10s., r. £93. 12s. | 390 |
| By R. J. COLLIER. | |
| Leytonstone—1 to 6, Queen's-ter., u.t. 89 yrs., g.r. £30 | 425 |
| Clapton—83, Median-rd., u.t. 76 yrs., g.r. £8 | 275 |
| Stoke Newington—8, Gainsborough-rd., u.t. 69 yrs., g.r. £5, r. £36 8s. | 280 |
| Walthamstow, Cumberland-rd., a plot of F land | 57 |
| Manor-rd., a plot of F land | 152 |
| By BEAL, SON, & CHARTRES. | |
| Fawkham, Kent—The Hartley Manor Estate of about 600 acres, f. | 10,000 |
| By INMAN, SHARP, HARRINGTON, & ROBERTS. | |
| Vauxhall—31, 33, and 35, South Lambeth-rd., f., r. £155 | 2,700 |
| Langley-lane—The Sunnybank Steam Laundry, f. | 6,000 |
| The Goodwill and Plant of the Effra Works | 90 |
| By H. N. NEWTON & CO. | |
| Westbourne-pk.—133, Ledbury-rd., u.t. 69 yrs., g.r. £10, r. £50 | 540 |
| FEB. 27. | |
| By MESSRS. TROLLOPE. | |
| Eaton-sq.—9a, Hobart-pl., u.t. 78 yrs., g.r. £27 | 2,100 |
| Belgravia—73 and 75, Belgrave-rd., u.t. 47 yrs., g.r. 2s., r. £280 | 3,850 |
| By C. C. & T. MOORE. | |
| Limehouse—30 and 32, Acland-st., u.t. 84 yrs., g.r. £9, r. £72. 16s. | 800 |
| Stepney—73, Charles-st., and 49, 51, and 53, Jamaica-st., u.t. 11 yrs., g.r. £8, r. £108 | 350 |
| Hackney—235, Dalston-lane, u.t. 49 yrs., g.r. £4. 16s. | 360 |
| By ROGERS & TEMPLE. | |
| Edgware-rd.—No. 118, u.t. 19 yrs., g.r. £5, 8s., r. £145 | 1,250 |
| Westgate-on-Sea, Roxburgh-rd.—"Donneva House," f. | 850 |
| St. Mildred's-rd.—A plot of f. land | 610 |
| By R. A. SAVAGE & SON. | |
| Mile-end—1, Bridge-st., f., r. £30 (licensed) | 830 |
| 3, Bridge-st., f. | 430 |

By Newbon & Harding.

| | |
|---|---|
| Camden-town—15, 16, and 17, Prebene-st., u.t. 32 yrs., g.r. £12, r. £88 | £750 |
| Homerton, Templar-rd.—F.g.r. of £14. 8s., with reversion in 70 yrs. | 340 |
| Pentonville, 36, Warton-st., u t. 36 yrs., g.r. £4 .. | 425 |
| Islington—77 and 79, Barnsbury-st., u.t. 19 yrs. g.r. £16, r. £82 | 400 |
| Waterloo-rd.—No. 62, u.t. 33 yrs., g.r. £9, r. £70 p.a. | 635 |
| Stoke Newington—43, Cazenove-rd., u.t. 83 yrs., g.r. £10 | 550 |

By E. Stimson.

| | |
|---|---|
| Peckham—47 to 50, Manaton-rd., u.t. 75 yrs., g.r. £18, r. £96. 8s. | 640 |
| 32, Queen's-rd., u.t. 20 yrs., g.r. £7 | 200 |
| 28 and 30, Langdale-rd., u.t. 53 yrs., g.r. £8. 8s., r. £62. 8s. | 315 |
| Newington Butts—77 and 79, Crampton-st., and a l.g r. of £5, u.t. 55 yrs., g r. £12 | 550 |
| Brixton-rd.—195, 195A, 197 and 199, u.t. 11 yrs., g.r. £24, r. £128 | 310 |

By Wilkinson, Son, & Welch (at Brighton).

| | |
|---|---|
| Brighton—9, Royal-crescent, f., r. £155 | 2,320 |

Feb. 28.—By Broad & Wiltshire.

| | |
|---|---|
| South Kensington—9, Gilston-rd., u.t. 40 yrs., g.r. £7 | 800 |

By Baker & Sons.

| | |
|---|---|
| Hampstead, Child's Hill—"Highway House," f. .. | 820 |
| Tottenham—48, Eastbourne-rd., u.t. 80 yrs., g.r. £5, r. £27. 6s. | 185 |

By Wagstaff & Warman.

| | |
|---|---|
| Hampstead-rd.—38, George-st., f., r. £50 | 1,000 |
| Hampstead-rd.—Nos. 259 and 261, u.t. 28 yrs., g.r. £46 | 645 |
| Islington—56, Brooksby-st., u.t. 19 yrs., g.r. £6. 6s., r. £30 | 160 |
| Barnsbury—38 and 40, Belitha Villas, profit rent of £12, u.t. 40 yrs. | 190 |
| St. Luke's, Royley-st.—Profit rent of £20, u.t. 15 yrs. | 150 |
| Twickenham—18, Netherton-rd., u.t. 91 yrs., g.r. £8. 10s., r. £35. | 310 |
| Upton-pk.—2, Seymour-buildings, u.t. 92 yrs., g.r. £5. 10s., r. £15. 12s. | 60 |
| City-rd.—An i.g.r. of £210, u.t. 4 yrs., subject to £110 g.r. | 20 |
| St. George's, E.—20 and 21, Princes-sq., u.t. 2½ yrs., g.r. £19. 15s., r. £48 | 21 |

[*Contractions used in these lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; yd. for yard, &c.]

## MEETINGS.

### Saturday, March 8.

*Architectural Association.*—Visit to Mr. Sedding's new church, Sloane-street.

*Royal Institution.*—The Right Hon. Lord Rayleigh, M.A., F.R.S., on "Electricity and Magnetism." IV. 3 p.m.

*Junior Engineering Society.*—Visit to the London Hydraulic Power Company's Pumping Stations. No. 1 at Falcon Wharf, Blackfriars (near the bridge). No. 2 at Millbank-street, Westminster (near the Houses of Parliament).

*Edinburgh Architectural Association.*—Visit to Free Library and Old University Buildings.

### Monday, March 10.

*Surveyors' Institution.*—Mr. T. W. Wheeler, Q.C., on "Betterments." 8 p.m.

*Institution of Civil Engineers.*—Students' visit to the s.s. *Jumna.* 12 noon.

### Tuesday, March 11.

*Society of Arts (Applied Art Section).*—Mr. James Orrock, R.I., on "The Claims of the British School of Painting to a thorough Representation in the National Gallery" 8 p.m.

*Institution of Civil Engineers.*—Discussion on the following papers (1): "The Hawkesbury Bridge, New South Wales." By Mr. C. O. Burge. (2) "The Construction of the Dufferin Bridge over the Ganges at Benares." By Mr. F. T. G. Walton. (3) "The New Blackfriars Bridge on the London, Chatham, and Dover Railway." By Mr. G. E. W. Cruttwell.

*Sanitary Institute (Lectures for Sanitary Inspectors).*—Mr. Charles E. Cassal, F.C.S., on "Food (including Milk), Sale of Food and Drugs Act." 8 p.m.

### Wednesday, March 12.

*Society of Arts.*—Sir Douglas Galton, F.R.S., on "The Chemin De Fer Glissant, or Sliding Railway." 8 p.m.

*Architects' Benevolent Society.*—The Fortieth Annual General Meeting of the Subscribers and Donors. 5 p.m.

*Free Lectures to Artisans and others on Matters Connected with Building.*—Professor Marshall Ward, M.A., on "The Tree, from the Sapling to the Bench." Carpenters' Hall, London-wall. 8 p.m.

*Sanitary Institute.*—Mr. W. Kinninmond Burton on "The Sanitary Condition of Japan." 8 p.m.

*Liverpool Engineering Society.*—Adjourned discussion on Mr. C. H. Yeaman's paper on "Central Station Electric Lighting." 8 p.m.

### Thursday, March 13.

*Institution of Electrical Engineers.*—Adjourned discussion on (1) Mr. J. Swinburne's paper on "The Theory of Armature Reaction in Dynamos and Motors"; (2) Mr. W. B. Esson's paper on "Some Points in Dynamo and Motor Design." 8 p.m.

### Friday, March 14.

*Architectural Association.*—Mr. Henry Holiday on "Modernism in Art." 7.30 p.m.

*Sanitary Institute (Lectures for Sanitary Inspectors).* Mr. Shirley F. Murphy on "Infectious Diseases and Methods of Disinfection." 8 p.m.

*Junior Engineering Society.*—Mr. A. H. Tyler on "Hydraulic Machine Tools." 7.45 p.m.

### Saturday, March 15.

*Royal Institution.*—The Right Hon. Lord Rayleigh, M.A., F.R.S., on "Electricity and Magnetism." V. 3 p.m.

## Miscellanea.

**"Fresco-Cement."**—On Wednesday, March 5, Mr. Edwin Lucas read an interesting paper before the Civil and Mechanical Engineers' Society (Mr. H. Adams in the chair) on a new medium for fresco-painting, called "Fresco-Cement." The composition, invented by Mr Kremeyer, consists largely of tufa, together with Portland cement and lime, and the patentee claims for it that being hydraulic, absorptive, and acid-proof, it is absolutely unaffected by the severest climate. The author gave a highly interesting *résumé* of the history of the art of fresco-painting, and of the various methods employed by great Italian masters, by the modern German school, and by artists in this country, dwelling on the great difficulties with which votaries of the art had to contend, on the elaborate nature of the processes required, and the want of permanence in the completed work. In illustration of the last defect, especially in our climate, he pointed to the fact that English artists had from the twelfth century devoted great attention to works of this nature, and asked, "Where are those works now"? He then proceeded to quote a favourable report from Mr. H. Faija, M.I.C.E., who had tested the strength of specimens which had been immersed in water for ninety-eight days. The average tensile strength of five specimens was found to be 312 lbs. per sq. in. The paper concluded with a practical demonstration of the extreme simplicity of the process by means of the portable fresco panels, which form a striking feature of the new invention.

**The English Iron Trade.**—The English iron market has not improved during the past week; if anything, it is rather flatter. There is also still the difficulty with the miners, the London conference having proved a failure, and this result cannot fail to disturb the iron trade. The Durham miners, on their part, have settled with the masters by accepting an advance of five per cent., and there is still a chance of wiser counsels prevailing in the southern coal-fields. The course of the warrant market continues downwards, and Scotch makers have followed by further lowering quotations. Although Cleveland pig-iron has been sold at 52s. and 51s. 9d. by merchants, makers hold on to 60s. Producers elsewhere are easier in their prices, yet not to the extent expected by would-be buyers. Makers of Bessemer iron in the north-west have gone back 5s. a ton, to 75s. Old materials have experienced a considerable drop. Manufactured iron is quieter, and lower in price in Scotland and the north of England, but steady further south. Steel can be bought at lower figures generally, rails especially. Orders for new ships are not to be secured at present, but builders have plenty to do. Engineers continue fairly busy; there is, however, a falling-off in new work.—*Iron.*

**Drainage of Cairo.**—We understand that Mr. Baldwin Latham, who left England early in November to advise the Egyptian Government as to the drainage of Cairo, has recommended a scheme for the sewerage of the city on the hydraulic system, at an estimated cost of 565,700*l.* That sanitation is receiving very great attention at the present time in the East, is evidenced by the fact that Mr. Latham, whilst at Cairo, was requested to extend his journey to Bombay, and has since been asked to advise as to the sewerage and water-supply of several other towns. Mr. Latham will have completed his investigations at Bombay shortly, and is expected in England about the middle of April.

**Obituary.**—The "Dombaumeister" of Strassburg, Herr A. Hartel, died last month, a few days before his forty-seventh birthday. He was known to be one of the first, if not the first, Gothic architect of the day in Germany; and his name is to be found among the winners of nearly all the great competitions of the last fifteen years. He had only occupied his present post some twelve months, and it will be difficult to find so suitable an artist to fill up the very important vacant place at Strassburg.

**East Dereham Local Board.**—The work of repaving the town has just been completed by the contractor, Mr. W. D. Hubbard, of East Dereham, the material used being the Imperial stone paving; in addition to this, granite channelling has been laid to the principal streets—the total cost being about 1,900*l.* The works were carried out under the directions of the Surveyor to the Board, Mr. F. W. Skipper.

**Surrey Archæological Society.**—At the recent annual meeting of this Society, held February 26 ult., at 8, Danes'-inn, Strand, Mr. J. W. Butterworth, F.S.A., presided. Mr. Mill Stephenson, F.S.A., hon. secretary, read the report of the Council, which stated that the appointment of a new Hon. Secretary in the place of Mr. T. Milbourn, resigned, having been referred by the last annual meeting to the Council, they, at a special meeting, held March 20, 1889, elected Mr. Mill Stephenson, F.S.A., and the Rev. T. S. Cooper, M.A., as Joint Hon. Secretaries. The question of the removal of the headquarters of the society to Guildford had also been referred to the Council, and a special committee was apppointed to consider it. The committee had a conference with the Mayor and Corporation of Guildford with regard to the tenancy of a house in Castle-arch, and it was determined to wait until such time as the house in question should be vacant. An afternoon meeting of the Society was held at Wandsworth on June 1, under the presidency of Viscount Midleton. The Manor House,* Church, and Public Library were visited, and papers on them read. The annual excursion, fixed for July 25, at Limpsfield and Titsey, had to be abandoned at the last moment, owing to the sudden death of Mr. Ronald Leveson-Gower. The Council regret that it was found impossible to arrange another at such short notice, and hope to be able to hold one or more afternoon meetings during the coming summer, in addition to the annual excursion. Part 2 of Vol. 9 was issued to members in June last. The volume for the year 1890 is now in the printer's hands, and will be issued in due course. The Council hope to be able for the future to publish with regularity. During the year two vacancies have occurred on the Council by death; the Rev. J. M. Braithwaite, M.A., Vicar of Croydon, and Lieut.-Colonel Eustace Anderson. Mr. John Oldrid Scott, F.S.A., has been elected a member of the Council. The number of members now is 302. The reserve fund consists of 338*l.* 13s. 3d. The library continues to increase by exchange with societies in union, and has also received several gifts from members. The Council has determined to proceed at once with a catalogue of the church plate of the county. The Rev. T. S. Cooper, M.A., one of the hon. secs., and a small committee have the matter in hand, and are now engaged in drawing up a circular to issue to the clergy, &c. The Archbishop of Canterbury, the Bishops of Rochester and Winchester, and the Archdeacons of Surrey, Southwark, and Kingston-on-Thames, have signified their approval of the scheme. The Council appeal to members for help in visiting the various districts, &c. Any members willing to assist are requested to communicate with the hon. secs.

**Christ Church, Bristol.**—The new organ-gallery at Christ Church, Bristol, is to be decorated with a series of eight carved panels. Two of these have just been fixed in position. One of them represents St. Cecilia seated at the organ, attended by St. Urban. This has been given to the church in memory of the late Mr. R. Benson. The other is a fine group, illustrating the Shepherds and the Herald Angels. This forms the centre or principal panel. Both panels are the work of Mr. George Houghton, of the Society of Bristol Sculptors.

## PRICES CURRENT OF MATERIALS.

| TIMBER. | £. | s. | d. | £. | s. | d. |
|---|---|---|---|---|---|---|
| Greenheart, B.G. ...ton | 7 | 0 | 0 | 7 | 15 | 0 |
| Teak, E.I. ...load | 12 | 0 | 0 | 14 | 0 | 0 |
| Sequoia, U.S. ...foot cube | 0 | 2 | 3 | 0 | 3 | 0 |
| Ash, Canada ...load | 3 | 0 | 0 | 4 | 5 | 0 |
| Birch " | 3 | 0 | 0 | 4 | 15 | 0 |
| Elm " | 3 | 10 | 0 | 4 | 15 | 0 |
| Fir, Dantsic, &c. | 2 | 0 | 0 | 3 | 10 | 0 |
| Oak " | 2 | 10 | 0 | 4 | 10 | 0 |
| Canada | 5 | 10 | 0 | 7 | 0 | 0 |
| Pine, Canada red | 2 | 10 | 0 | 3 | 10 | 0 |
| " yellow | 3 | 0 | 0 | 5 | 5 | 0 |
| Lath, Dantsic ...fathom | 4 | 10 | 0 | 5 | 10 | 0 |
| St. Petersburg | 5 | 0 | 0 | 6 | 10 | 0 |
| Wainscot, Riga, &c. ...log | 0 | 0 | 0 | 0 | 0 | 0 |
| Deals, Finland, 2nd and 1st. std. 100 | 8 | 10 | 0 | 11 | 0 | 0 |
| " " 4th and 3rd | 7 | 0 | 0 | 8 | 0 | 0 |
| Deals—Riga | 7 | 0 | 0 | 9 | 0 | 0 |
| St. Petersburg, 1st yellow | 11 | 0 | 0 | 14 | 0 | 0 |
| " 2nd " | 9 | 0 | 0 | 10 | 10 | 0 |
| " white | 6 | 10 | 0 | 10 | 0 | 0 |
| Swedish | 7 | 10 | 0 | 16 | 0 | 0 |
| White Sea | 9 | 0 | 0 | 17 | 0 | 0 |
| Canada, Pine, 1st | 16 | 0 | 0 | 26 | 0 | 0 |
| " " 2nd | 11 | 0 | 0 | 17 | 10 | 0 |
| " " 3rd, &c. | 8 | 0 | 0 | 10 | 10 | 0 |

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* The old Manor House, since pulled down, will be found illustrated in the *Builder*, August 24, 188

| TIMBER (*continued*). | £. | s. | d. | £. | s. | d. |
|---|---|---|---|---|---|---|
| Deals, Canada Spruce, 1st | 9 | 0 | 0 | 11 | 0 | 0 |
| ,, ,, 3rd and 2nd | 7 | 0 | 0 | 9 | 0 | 0 |
| New Brunswick, &c. | 6 | 0 | 0 | 8 | 10 | 0 |
| Battens, all kinds | 6 | 0 | 0 | 17 | 0 | 0 |
| Flooring Boards, sq., 1 in., prepared, First | 0 | 11 | 0 | 0 | 14 | 0 |
| Second | 0 | 8 | 0 | 0 | 10 | 6 |
| Other qualities | 0 | 6 | 0 | 0 | 7 | 9 |
| Cedar, Cuba ......foot | 0 | 0 | 4 | 0 | 0 | 5 |
| Honduras, &c. | 0 | 0 | 4 | 0 | 0 | 4½ |
| Mahogany, Cuba | 0 | 0 | 5 | 0 | 0 | 6½ |
| St. Domingo, cargo average | 0 | 0 | 5 | 0 | 0 | 6½ |
| Mexican, cargo average | 0 | 0 | 4½ | 0 | 0 | 5½ |
| Tobasco ,, | 0 | 0 | 5½ | 0 | 0 | 6½ |
| Honduras ,, | 0 | 0 | 5½ | 0 | 0 | 6½ |
| Box, Turkey ......ton | 4 | 0 | 0 | 13 | 0 | 0 |
| Rose, Rio | 15 | 0 | 0 | 20 | 0 | 0 |
| Bahia | 14 | 0 | 0 | 18 | 0 | 0 |
| Satin, St. Domingo ......foot | 0 | 0 | 9 | 0 | 1 | 3 |
| Porto Rico | 0 | 0 | 10 | 0 | 1 | 6 |
| Walnut, Italian | 0 | 0 | 4½ | 0 | 0 | 6½ |
| **METALS.** | | | | | | |
| Iron— Bar, Welsh, in London ....ton | 0 | 0 | 0 | 0 | 0 | 0 |
| ,, ,, at works in Wales | 0 | 0 | 0 | 0 | 0 | 0 |
| ,, Staffordshire, in London | 8 | 10 | 0 | 9 | 10 | 0 |

| METALS (*continued*). | £. | s. | d. | £. | s. | d. |
|---|---|---|---|---|---|---|
| COPPER—British, cake and ingot | 53 | 10 | 0 | 0 | 0 | 0 |
| Best selected | 55 | 0 | 0 | 0 | 0 | 0 |
| Sheets, strong | 62 | 0 | 0 | 0 | 0 | 0 |
| Chili, bars | 47 | 0 | 0 | 0 | 0 | 0 |
| YELLOW METAL ......lb. | 0 | 0 | 5¾ | 0 | 0 | 6 |
| LEAD—Pig, Spanish ......ton | 12 | 10 | 3 | 0 | 0 | 0 |
| English, com. brands | 12 | 10 | 0 | 12 | 12 | 6 |
| Sheet, English | 14 | 15 | 0 | 0 | 0 | 0 |
| Pipe | 15 | 5 | 0 | 0 | 0 | 0 |
| TIN—Straits | 90 | 0 | 0 | 0 | 0 | 0 |
| Australian | 90 | 0 | 0 | 0 | 0 | 0 |
| English Ingots | 95 | 0 | 0 | 0 | 0 | 0 |
| **OILS.** | | | | | | |
| Linseed ......ton | 22 | 15 | 0 | 23 | 0 | 0 |
| Cocoanut, Cochin | 26 | 10 | 0 | 0 | 0 | 0 |
| Cocoanut, Ceylon | 24 | 15 | 0 | 25 | 0 | 0 |
| Palm, Lagos | 24 | 0 | 0 | 24 | 10 | 0 |
| Rapeseed, English pale | 34 | 0 | 0 | 0 | 0 | 0 |
| ,, brown | 32 | 10 | 0 | 0 | 0 | 0 |
| Cottonseed, refined | 22 | 10 | 0 | 0 | 0 | 0 |
| Tallow and Oleine | 21 | 0 | 0 | 40 | 0 | 0 |
| Lubricating, U.S. | 5 | 10 | 0 | 6 | 10 | 0 |
| ,, refined | 7 | 0 | 0 | 12 | 0 | 0 |
| TAR—Stockholm ......barrel | 1 | 6 | 0 | 0 | 0 | 0 |
| Archangel | 0 | 17 | 6 | 0 | 0 | 0 |

# COMPETITIONS, CONTRACTS & PUBLIC APPOINTMENTS.

*Epitome of Advertisements in this Number.*

## COMPETITIONS.

| Nature of Work. | By whom Required. | Premium. | Designs to be delivered. | Page |
|---|---|---|---|---|
| Works at New Cemetery | Willesden Burial Bd. | 50*l.* and 25*l.* | April 30th | ii. |
| New Offices | Oldham School Board | 50*l.*, 30*l.*, and 20*l.* | do. | xiii. |

## CONTRACTS.

| Nature of Work or Materials. | By whom Required. | Architect, Surveyor, or Engineer. | Tenders to be delivered. | Page. |
|---|---|---|---|---|
| Silicated Concrete Pipes | Norwich Town Council | P. P. Marshall | Mar. 11th | ii. |
| Portland Cement | do. | do. | do. | ii. |
| Compressed Bricks | do. | do. | do. | ii. |
| Additional W.C.'s, &c., at Infirmary | Hackney Union | W. Barnett | Mar. 12th | xiv. |
| Road Materials, Royal Parks | Com. of H.M. Works | *Official* | do. | xiii. |
| Roadmaking and Paving Works | Hammersmith Vestry | H. Mair | do. | ii. |
| Wrought-iron Fencing, &c. | Hastings Union | Philip H. Tree | Mar. 13th | ii. |
| Formation of Roads, Surface Drainage, &c. | do. | do. | do. | ii. |
| Works and Materials | Hornsey Local Board | T. de Courcy Meade | Mar. 14th | xiv. |
| Works and Materials | Bath U.S.A. | C. R. Fortune | Mar. 15th | ii. |
| Stone for Macadamising | Hull Corporation | A. E. White | Mar. 17th | ii. |
| Sewerage Works, Kentish Town | London County Council | *Official* | do. | xiii. |
| Filling-up Grips in Precipitation Channels, &c. | do. | do. | do. | ii. |
| Roadmaking Works | Finchley Local Board | do. | do. | xiv. |
| Works and Materials | do. | F. Smythe | do. | xiv. |
| Roadmaking Works | Southend Local Board | P. Dodd | Mar. 18th | xiv. |
| Stone Paving | Com. of Sewers | *Official* | do. | xiv. |
| Maintenance and Repairs of Main Roads | County of Kent | F. W. Ruck | do. | xiv. |
| Waterworks | West Cowes Local Bd. | N. F. Dennis | do. | xiv. |
| New Church, near Rawtenstall | The Committee | Paley & Austin | do. | xiv. |
| Roadmaking Works | Lewisham Bd. of Works | *Official* | do. | xiv. |
| Supply of Materials | Carlisle Corporation | W. H. Smith | Mar. 19th | xiv. |
| Wrought-iron Bridge, near Reading | Berkshire County Coun. | J. Morris | Mar. 21st | xiv. |
| Enlargement of the Norwich Post-office | Com. of H.M. Works | *Official* | Mar. 25th | xiii. |
| Enlargement of Post-office, Newport (Mon.) | do. | do. | Mar. 26th | xiii. |
| Construction of Railway | G. W. R. Co. | do. | do. | xiv. |
| Covered Way from Infirmary to Chapel | Fulham Union | do. | Mar. 27th | xiv. |
| Convalescent Home, Broadstairs | N. Surrey School Dist. Managers | J. R. Vining | Mar. 29th | xiv. |
| Roadmaking and Sewer Works | Hanwell Local Board | E. J. W. Herbert | April 1st | xiv. |
| Superstructure of New P.O., St. Martin's-le-Grand | Com. of H. M. Works | *Official* | April 3rd | xiii. |
| New Infirmary Buildings | St. Olave's Union | Newman & Newman | Not stated. | xiv. |
| Drying Closets, Turkish Bath, &c. &c. | Sussex County Asylum | H. Card | do. | xiii. |

## PUBLIC APPOINTMENTS.

| Nature of Appointment. | By whom Advertised. | Salary. | Applications to be in. | Page. |
|---|---|---|---|---|
| Book-keeper and Clerk (Surveyors' Dept.) | St. George (Hanover-square) Vestry | 120*l.* | Mar. 10th | xviii. |
| Inspector of Nuisances | Wimbledon Local Bd. | 125*l.* | Mar. 12th | xviii. |
| Road Surveyor | Enfield Local Board | 200*l.*, &c. | Mar. 17th | xix. |
| Inspectors (2) of Weights and Measures | Monmouth County Coun | 150*l.* each | Mar. 21st | xviii. |
| General Road Foreman | St. George-the-Martyr (Southwark) Vestry | 3*l.* weekly | April 19th | xviii. |

## TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *noon on Thursdays.*]

AYLESBURY.—For alterations and additions to Dinton Hall, near Aylesbury, for Colonel Goodall. Mr. Alfred Bovill, architect, 24, Charing Cross. Quantities supplied by Messrs. Pryce Cuxson & Leigh, 17, Victoria-street, Westminster, S.W. :—

| | | | |
|---|---|---|---|
| Stanley G. Bird | £3,576 | 0 | 0 |
| Thos. Rider & Son | 3,468 | 0 | 0 |
| Holloway Bros. | 2,869 | 0 | 0 |
| Ball & Mayne | 2,438 | 3 | 6 |

BURTON-ON-TRENT.—For new farm-buildings at Callingwood Hall, near Burton-on-Trent, for the Right Hon. Lord Burton. Mr. Richard Waite, architect, Duffield, Derby :—

| | | | |
|---|---|---|---|
| W. Sharp, Barton-under-Needwood | £4,760 | 0 | 0 |
| Lowe & Sons, Burton-on-Trent | 4,500 | 0 | 0 |
| G. Hodges, Burton-on-Trent | 4,330 | 0 | 0 |
| Walker & Slater, Derby (accepted) | 4,300 | 0 | 0 |

CHINGFORD.—For works of sewerage at Chingford, for the Epping Rural Sanitary Authority. Mr. Edmond Egan, A.R.I.B.A., engineer. Quantities supplied :—

| | | | |
|---|---|---|---|
| T. Marney, Forest Gate | £646 | 18 | 9 ! |
| J. Garton, Stamford Hill | 580 | 19 | 0 |
| W. Wood, Mile End-road | 529 | 0 | 0 |
| H. Hill, Maidenhead | 525 | 8 | 0 |
| Collier & Catley, Reading | 511 | 0 | 0 |
| J. Jackson, Plaistow | 510 | 0 | 0 |
| G. Bell, Tottenham | 510 | 0 | 0 |
| Eli Wilson, Walthamstow | 478 | 0 | 0 |
| H. Lee, Southall | 465 | 3 | 10 |
| Jesse Jackson, Leyton | 462 | 0 | 0 |
| Bloomfield, Tottenham | 422 | 5 | 0 |
| Cornish, Loughton | 410 | 0 | 0 |
| H. Wells, Buckhurst Hill | 398 | 0 | 0 |
| R. Stroud, Ilford | 397 | 14 | 0 |
| W. Nicholls, Wood Green | 390 | 0 | 0 |
| W. Gladdin, Mile End | 384 | 0 | 0 |
| W. French, Buckhurst Hill* | 376 | 10 | 0 ! |

* Accepted.

EAST DEREHAM.—For the erection of a mortuary for the East Dereham Local Board. Mr. F. W. Skipper, architect and surveyor, East Dereham :—

| | | | |
|---|---|---|---|
| Hubbard | £129 | 0 | 0 |
| Mayes | 128 | 5 | 7 |
| Beeston | 120 | 0 | 0 |
| Mack | 112 | 10 | 0 |
| Larner (accepted) | 112 | 0 | 0 |

HESWALL.—For the construction of public sewers, at Heswall, Cheshire, for the Wirral Rural Sanitary Authority. Mr. Charles H. Beloe, M.Inst.C.E., 13 Harrington-street, Liverpool, engineer. Quantities Mr. Frank E. Priest, Assoc.M.Inst.C.E., Liverpool :—

| | | | |
|---|---|---|---|
| J. Taylor, Garston | £9,000 | 0 | 0 |
| Sterling & Swann, Manchester | 6,800 | 0 | 0 |
| W. Vaughan, Wrexham | 6,300 | 0 | 0 |
| J. Dovenor & Co., Liverpool | 6,233 | 0 | 0 |
| Monk & Newell, Bootle | 6,179 | 10 | 6 |
| W. Hope, Liverpool | 5,997 | 12 | 10 |
| R. Malabar, Liverpool | 5,959 | 0 | 0 |
| Thornton & Son, Liverpool | 5,935 | 0 | 0 |
| J. McCabe & Co., Liverpool | 5,924 | 16 | 2 |
| J. Fish & Co., Preston | 5,450 | 0 | 0 |
| Powell & Thackleton, Chester | 5,366 | 15 | 2 |
| Fawkes Bros., Southport | 5,100 | 0 | 0 |
| Holme & King, Liverpool | 4,760 | 0 | 0 |
| A. Bleakley & Son, Birkenhead | 4,635 | 0 | 0 |
| Thomas & Co., Liverpool* | 4,416 | 16 | 0 |

* Accepted.

KENLEY (Surrey).—For alterations to billiard-room at Rook House, Kenley, for Mr. Oliver Barnett :—

| | | | |
|---|---|---|---|
| Robert Eddie (accepted) | £236 | 0 | 0 |

LEYTONSTONE (Essex).—For building two cottages, Eve-road, Leytonstone, Essex, for Mr. J. Needham. Mr. Joseph G. Needham, architect, 11, Powerscroft-road, Lower Clapton, N. :—

| | | | |
|---|---|---|---|
| J. & F. Baul (accepted) | £396 | 0 | 0 |

LONDON.—For alterations and additions to the London Hospital, Whitechapel-road, E., for the Governors of the London Hospital. Mr. Rowland Plumbe, architect, 13, Fitzroy-square, W. Quantities by Messrs. Fowler & Hugman, 9, Craig's-court, Charing-cross, W.C., and the architect :—

| | | | |
|---|---|---|---|
| Hart Bros. | £20,180 | 0 | 0 |
| W. Goodman | 20,020 | 0 | 0 |
| J. F. Sergeant | 20,000 | 0 | 0 |
| Holloway Bros. | 19,787 | 0 | 0 |
| Ashby Bros. | 19,770 | 0 | 0 |
| Rider & Son | 19,611 | 0 | 0 |
| J. Morter | 19,483 | 0 | 0 |
| B. E. Nightingale | 19,481 | 0 | 0 |
| Kirk & Randall | 19,446 | 0 | 0 |
| Killby & Gayford | 19,346 | 0 | 0 |
| J. T. Messum | 19,040 | 0 | 0 |
| W. Shepherd | 18,815 | 0 | 0 |
| Perry & Co. | 18,813 | 0 | 0 |

LONDON.—For the erection of factory at Millwall. Mr. G. Blyton, architect. Quantities supplied :—

| | | | |
|---|---|---|---|
| R. Cooper & Sons | £7,816 | 0 | 0 |
| G. Barker | 7,415 | 0 | 0 |
| G. Law & Son | 7,376 | 0 | 0 |
| C. Crave | 7,200 | 0 | 0 |
| W. Neill | 6,650 | 0 | 0 |
| S. Salt | 6,117 | 0 | 0 |
| Shillitoe & Sons | 6,040 | 0 | 0 |
| Barrett & Power | 6,016 | 0 | 0 |
| Dearing & Sons | 5,793 | 0 | 0 |
| Wilkinson Bros. | 5,735 | 0 | 0 |
| J. K. Coleman | 5,700 | 0 | 0 |
| J. Allen & Son | 5,690 | 0 | 0 |
| Battey & Linfoot | 5,642 | 0 | 0 |
| R. S. Battey | 5,570 | 0 | 0 |
| F. & H. F. Higgs | 5,570 | 0 | 0 |
| Olver & Richardson | 5,496 | 0 | 0 |
| J. Holland | 5,487 | 0 | 0 |
| Garlick & Horton | 5,476 | 0 | 0 |
| Pattinson & Sons | 5,472 | 0 | 0 |
| W. M. Dabbs | 5,460 | 0 | 0 |
| J. O. Richardson | 5,216 | 0 | 0 |
| J. Parnell & Son | 5,156 | 0 | 0 |
| Wall Bros. | 5,097 | 0 | 0 |
| G. Stephenson (accepted) | 4,987 | 0 | 0 |

LONDON.—For erecting a Girls' Industrial Home and Laundry at Forest-hill. Mr. Thos. W. Aldwinckle, 2, East India-avenue, Leadenhall-street, E.C., architect. Quantities supplied :—

| | | | |
|---|---|---|---|
| Waddington & Co. | £4,950 | 0 | 0 |
| Roberts | 4,625 | 0 | 0 |
| Holliday & Greenwood | 4,239 | 0 | 0 |
| G. E. Todd | 4,149 | 0 | 0 |
| Holloway Bros. | 4,086 | 0 | 0 |
| Lorden & Son | 3,987 | 0 | 0 |
| W. Johnson | 3,810 | 0 | 0 |

[This list was received too late for insertion last week.]

LONDON.—For reconstruction of the workhouse, King's-road, St. Pancras, for the Guardians of the Parish of St. Pancras. Messrs. A. & C. Harston, architects, 15, Leadenhall-street, E.C. Quantities supplied by Messrs. Corderoy & Selby and Mr. W. T. Farthing :—

Kirk & Randall, Woolwich, accepted, £74,827.

[Sent too late for insertion last week. Full list appeared in the *Builder* for February 22.]

LONDON.—For various fittings for the Shire Horse Society, at The Royal Agricultural Hall, Islington :—

| | | | |
|---|---|---|---|
| Robert Eddie, 17, Tindale-place, Upper-street, N. (accepted) | £1,200 | 0 | 0 |

Further fittings (unlimited) at per schedule.

LONDON.—For alterations and additions to the "George" public-house, Long-lane, Bermondsey. Mr. E. E. Niblett, architect, Hackney, E. :—

| | | | |
|---|---|---|---|
| Spencer & Co. | £1,068 | 0 | 0 |
| Burman & Son | 1,047 | 0 | 0 |
| Gregory & Co.* | 1,025 | 0 | 0 |

* Accepted at revised estimate, £830.

LONDON.—For alterations and additions to the "Magnet" public-house, Old Kent-road, S.E. Mr. E. E. Niblett, architect :—

| | | | |
|---|---|---|---|
| Spencer & Co. | £840 | 0 | 0 |
| Gregory & Co. | 828 | 0 | 0 |
| Burman & Sons* | 806 | 0 | 0 |

* Accepted at revised estimate, £625.

LONDON.—For additions to buildings at Acre-street, Wandsworth, for "The Projectile Co.," Limited. Messrs. Tolley & Son, architects, 66, Cannon-street, E.C. :—

| | | | |
|---|---|---|---|
| Shepherd, London | £1,236 | 0 | 0 |
| Faulkner, London | 1,137 | 0 | 0 |
| Waddington, Sydenham (accepted) | 1,127 | 0 | 0 |

LONDON.—For alterations and additions to the "Earl of Warwick" public-house, Golbourne-road, Westbourne Park, for Mr. Geo. Branson. Mr. E. E. Niblett, architect :—

| | | | |
|---|---|---|---|
| Burman & Son | £582 | 0 | 0 |
| Ransom & Co. | 494 | 6 | 0 |
| Spencer & Co. | 430 | 0 | 0 |
| *Gasfitting.* | | | |
| Morris | 104 | 5 | 0 |

LONDON.—For alterations and repairs at "The Rotherfield Arms," Shepperton-road, Islington, N., for Mr. B. P. Lucas. Mr. C. A. Legg, architect, 13, Grafton-street, Mile-end :—

| | | | |
|---|---|---|---|
| F. Schroeder & Co. | £458 | 3 | 6 ! |
| Shurmur | 267 | 0 | 0 |
| Anley | 247 | 0 | 0 |
| Pickford | 235 | 0 | 0 |
| Weibking (accepted) | 211 | 10 | 0 |
| Chillingworth | 196 | 1 | 0 ! |

LONDON.—For additions to No. 31, Endell-street, St. Giles, for Mr. W. W. Langley. Mr. E. P. Loftus Brock, F.S.A., architect :—

| | | | |
|---|---|---|---|
| Patman & Fotheringham | £1,357 | 0 | 0 |
| Mark Patrick & Son | 1,338 | 0 | 0 |
| Puzey & Lumley | 1,290 | 0 | 0 |
| Kynoch & Co. | 1,241 | 0 | 0 |
| Matthew Scott | 1,027 | 10 | 0 |

LONDON.—For alterations to the "Bell" Tavern, High-street, Shoreditch, E.C., for Messrs. Garner & Leng. Mr. Joseph G. Needham, architect, 11, Powerscroft-road, Lower Clapton, N. :—

| | | | |
|---|---|---|---|
| Walker Bros. | £948 | 0 | 0 |
| J. Amley | 939 | 0 | 0 |
| G. Lusk | 900 | 0 | 0 |
| W. Kellaway | 787 | 0 | 0 |
| Mower & Son | 697 | 0 | 0 |
| A. Hood (accepted) | 689 | 0 | 0 |
| *Gas-fittings.* | | | |
| J. Steadman (accepted) | 113 | 17 | 6 |

LONDON.—For constructing about 100 ft. of 4 ft. by 2 ft. 6 in. brick sewer, in portion of Myddelton-street, for the Vestry of Clerkenwell. Mr. William Iron, surveyor :—

| | | | |
|---|---|---|---|
| G. Bell, Tottenham | £206 | 0 | 0 |
| Mowlem & Co., Westminster | 195 | 0 | 0 |
| J. Pizzey, Haringay | 194 | 0 | 0 |
| J. Dickson, St. Albans | 170 | 0 | 0 |

[Surveyor's estimate, £153.]

LONDON.—For laying-out churchyard of St. James, Clerkenwell, as the public garden, and also for throwing part of the churchyard into the public way in St. James's-walk, for the Vestry of Clerkenwell :—

| | | | |
|---|---|---|---|
| Mowlem & Co., Westminster | £1,143 | 0 | 0 |
| W. Benedict, Newington Butts | 1,105 | 10 | 0 |
| G. Bell, Tottenham | 948 | 0 | 0 |

[Surveyor's estimate, £1,033.]

LONDON.—For fitting-up shop, No. 22, Sloane-street, for Mr. L. M. Pearce :—

| | | | |
|---|---|---|---|
| Robert Eddie (accepted) | £147 | 0 | 0 |

LONDON.—For alterations and additions for Mr. Hart, 2, Settle-street, Commercial-road, E. Mr. Lewis Solomon, architect, 55, New Broad-street, E.C. :—

| | | | |
|---|---|---|---|
| Lusk, Mile End | £450 | 0 | 0 |
| Triggs, Prescot-street | 446 | 0 | 0 |
| Roberts, Islington | 439 | 0 | 0 |
| Bramley, Stoke Newington* | 330 | 0 | 0 |

* Accepted.

ORPINGTON.—For additions and alterations to the Board Schools, Orpington, Kent, for the Orpington School Board. Mr. St. Pierre Harris, architect, 1, Basinghall-street, E.C. Quantities by Messrs. C. Stanger & Son, 21, Finsbury Pavement :—

| | | | |
|---|---|---|---|
| R. A. Lowe | £2,497 | 0 | 0 |
| G. Stevenson | 2,371 | 0 | 0 |
| Wm. Simms | 2,302 | 0 | 0 |
| R. Battley | 2,271 | 0 | 0 |
| M. Marsland | 2,217 | 0 | 0 |
| T. Knight | 2,211 | 0 | 0 |
| C. Satchell | 2,195 | 0 | 0 |
| D. Payne | 2,175 | 0 | 0 |
| D. Holt & Son | 2,170 | 0 | 0 |
| Akers & Co. | 2,141 | 0 | 0 |
| Somerford & Son (accepted) | 2,132 | 0 | 0 |
| A. & W. Garnar | 2,113 | 0 | 0 |
| W. A. Grubb | 2,089 | 0 | 0 |

[This list was received too late for insertion last week.]

LONDON.—For rebuilding No. 85, Mansell-street, Aldgate. Mr. R. W. Hobden, architect. No quantities supplied :—

| | | | |
|---|---|---|---|
| Joscelyne & Young | £1,857 | 0 | 0 |
| J. O. Richardson | 1,767 | 0 | 0 |
| A. Allard (accepted) | 1,722 | 0 | 0 |

TWICKENHAM.—For constructing and fixing a carved pine fitment and cornice for drawing-room, and laying an oak parquet floor in same, for Major-General Bonus, The Cedars, Strawberry Hill. Mr. J. A. Stenhouse, architect :—

| | | | |
|---|---|---|---|
| C. Hindley & Sons (accepted) | £126 | 10 | 0 |

WIMBLEDON.—For the erection of a steam laundry at Raynes Park, Wimbledon. Mr. M. Guy Ogden, architect, Wimbledon :—

| | | | |
|---|---|---|---|
| Munday, Wimbledon | £1,170 | 0 | 0 |
| Gibbard, Wimbledon | 1,164 | 7 | 6 |
| James, Wimbledon * | 1 144 | 10 | 0 |

* Accepted, subject to modifications.

*No senders' names.*—Lists of tenders for works at Chislehurst, Richmond, Rushey Green, and Swanley, received without senders' names, are ineligible for insertion on that account.

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